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COMING SOON

An article on practical yellow gold plating, including the production of colored gold deposits.

The safe use of perchloric-acetic acid electropolishing baths is explained in a timely article by Dr. Jacquet.

How hard nickel plating is used in industrial engineering applications.

A study of copper plating from phosphoric acid baths.

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DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

VOLUME 47 • NUMBER 10 • OCTOBER, 1949

Economy in Production

Economy in production, the theme of the 31st Metal Show being held this month in Cleveland, is a topic especially in keeping with the times and conditions in the plating industry. In the concentrated drive for lower overall costs in the production of every conceivable type of product, rare indeed is the finishing department where the word "economy" has not become almost a nightmare to supervisors. Even more rare would be the finishing department where adoption of newer materials, techniques or equipment would not result in substantial savings or increased production.

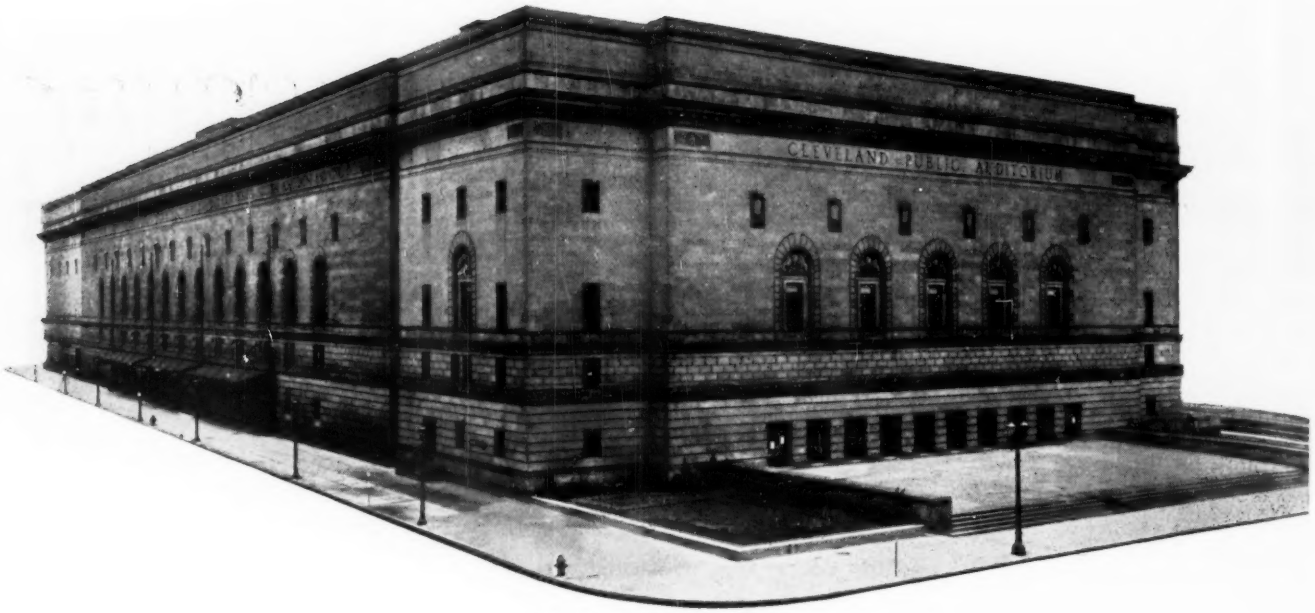
In spite of the progress made in the past few years, there are still far too many finishing operations that are leading a "double life"—living under the same roof with soundly engineered and scientifically controlled processes of the machine shops and assembly lines while at the same time "married" to the ideology that metal finishing operations must forever remain more or less of an "art". Nothing could be more erroneous, for there is hardly any finishing operation from the first preliminary surfacing to the final drying off that cannot be improved upon, or even be performed automatically. Anyone who doubts this should talk to one of the many highly trained representatives of the various manufacturers of finishing equipment, or let him look over their plating operations and equipment. The chances are that he will spot numerous possibilities for improvement in their activities.

Yours is a special problem? Everybody's is. You might be pleasantly surprised to find that your special problem has already been mastered and that a machine is available to do the job automatically. With the present emphasis on "engineered" selling, as contrasted to the long years of stock item manufacture, suppliers are more inclined and better equipped to furnish specialized equipment ideally suited to your operations.

All this equipment takes money? It always has. It also takes courage and foresight to invest in new equipment in times of slack business activity, but it is just that sort of courage and foresight that has been behind every era of profits and prosperity in our business history, and which has been the basis for the traditional efficiency of American production methods.

To again borrow a phrase from the Metal Show theme, the "know-how" and "show how" are available—it's up to each metal finisher to determine where and how they can be applied to promote ECONOMY IN PRODUCTION in his own plant.

W. A. Raymond



Cleveland Public Auditorium

31st NATIONAL METAL SHOW TO FEATURE ECONOMY IN PRODUCTION

CLEVELAND OCTOBER 15-21

APPROXIMATELY 350 nationally known firms engaged in either the production of metals, the treatment of metals, their fabrication, or in rendering services to all of these, will exhibit their products, equipment or services in Cleveland's huge Public Auditorium during the five days of the 31st National Metal Congress and Exposition which will be held on October 15-21.

As in past years, the sponsoring societies for this Metal Show are the American Society for Metals, the American Welding Society, the Metals Branch of the American Institute of Mining and Metallurgical Engineers, and The Society for Non-Destructive Testing. In addition to the Show, a comprehensive program of technical papers will be presented during the sessions which will be held at the Hotels Statler, Cleveland, and Allerton.

The theme of the 1949 Metal Show is "Economy in Production," and all activities throughout the week will in one way or another stress this thought. The principal purpose of the Show is to bring together the experience, the knowledge and the means for producing and fabricating metals to the end that the best of all these will be more widely known and understood, and that the exchange of ideas and the demonstration of equipment will enable the metals industry as a whole to progress and support the needs for better metals, more economical methods, and greater usefulness for products made of metals.

Many special features are scheduled for the Cleveland Metal Show. Each day, Monday through Friday, there will be the round table discussions on the Show's theme "Economy in Production." Eight of these round table sessions will be held. Another feature will be the "Economy Theatre," which will enable exhibitors having motion pictures depicting "Economy in Production" through the use of their equipment, processes or services, to show such films to responsive and interested audiences in one of the "Economy Theatres." During the week of the Metal Show there will be regular published schedules of these motion pictures, which will be shown in one of the many exhibit halls in the Cleveland Public Auditorium.

Seminar sessions on "Thermodynamics in Physical Metallurgy" will occur in the morning, afternoon and evening on Saturday, and morning and afternoon on Sunday. These important technical meetings, sponsored by the American Society for Metals, will be held in Cleveland's Hotel Statler.

New Officers to Take Office

The following will take office on October 19, 1949:

President — *Arthur E. Focke*, now Vice President. One year term.

Vice President — *Walter E. Jominy*, Staff Engineer, Chrysler Corporation, Detroit. One year term.

Treasurer — *Ralph L. Wilson*, Chief Metallurgical Engineer, Timken Steel and Tool Division. Two year term.

On Wednesday, Oct. 19, the Annual Meeting of the Society will be held, at which time *Mr. E. H. Dix, Jr.*, Assistant Director of Research, Aluminum Co. of America, will deliver the Edward DeMille Campbell Memorial Lecture.

Presentation of three top awards will be a feature of the annual dinner of the American Society for Metals, Thursday, October 20th, which will be held in the Grand Ballroom of Hotel Statler, Cleveland, Ohio.

The Sauveur Achievement Award will be presented in 1949 to *Dr. Marcus A. Grossmann*, Director of Research, Carnegie-Illinois Steel Corporation. Dr. Grossmann is the thirteenth

metal scientist to receive the Award since it was first established and presented in 1934 to *Dr. Albert Sauveur,* the late Harvard Professor, and widely known as the "Dean of American Metallurgists."

Dr. Grossmann presented the Campbell Memorial Lecture to the National Metal Congress in 1930. He was Vice President in 1943 and was elected President in 1944. At the 1948 National Metal Congress and Exposition, Dr. Grossmann received the ASM Distinguished Service Award for meritorious contributions to progress in alloy steel.

Dr. Edgar Collins Bain, Vice President, Carnegie-Illinois Steel Corporation, is the 1949 recipient of the American Society for Metals' Gold Medal. Presentation of the Gold Medal to Dr. Bain will be made at the annual dinner of the American Society for Metals.

Dr. Bain is a past President of the American Society for Metals and has made notable contributions to the art and science of Metals through his active membership in the Society. The 1949 Gold Medalist was the Henry Marion Howe lecturer in 1931 and the Edward deMille Campbell lecturer in 1952. In 1946 Dr. Bain received the Albert Sauveur Achievement Medal from the Society, and in 1948 he received the Distinguished Service Award for his meritorious contributions to progress in Alloy Steel.

The 1949 Medal for the Advancement of Research has been awarded to *Fred H. Haggerson,* President of Union Carbide and Carbon Corporation, and one of industry's leading exponents of consistent research.

For 20 years Mr. Haggerson has been an outstanding example of a modern executive in a manufacturing enterprise, employing industrial research as an effective aid in the achievement of commendable business objectives. Mr. Haggerson has advanced technological progress in broad fields of the metal industry through his constant support of sustained research dealing with new alloys and their properties, alloying and accessory steelmaking materials, as well as welding and other processing methods. The ASM Medal for the Advancement of Research is based on these qualifications which Mr. Haggerson fulfills to a high degree.

Arthur E. Focke
ASM President 1949-50

EXHIBITORS IN THE METAL FINISHING FIELD

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(Concluded on page 117)

LaSalle Hotel

ELECTROCHEMICAL SOCIETY

96th MEETING — OCTOBER 12-15

LaSALLE HOTEL CHICAGO, ILL.

THE 96th meeting of the Electrochemical Society will be held on October 12-15 at the LaSalle Hotel, Chicago. An extensive technical program will be presented, including three symposia on Corrosion, Electro-Organic, and Electrodeposition. Of special interest to electroplaters will be the Symposium on Electrodeposition, during which a number of important papers on the deposition of special metals and alloys will be presented. The deposition of molybdenum, copper-lead alloys, hard chromium, tin and chrome-tungsten alloys will be covered, in addition to many others. A short symposium on chrome plating is also planned for Saturday morning. The electroplating sessions will be held on Friday afternoon and Saturday morning, under the Chairmanship of *Dr. R. A. Schaefer*, Director of Research, Cleveland Graphite Bronze Co. A complete list of the papers to be presented is given elsewhere in this report.

Wednesday, October 12th, will be devoted to Committee and Board meetings, with the technical program getting under way on Thursday morning.

In addition to the technical sessions, an interesting program for entertaining the ladies who attend has been planned, as well as luncheons, plant trips, and evening entertainment. For Thursday evening a dinner dance has been scheduled.

The Electrodeposition Division will have a special luncheon on Saturday, honoring *Prof. Frank C. Mathers*, Professor of Chemistry at Indiana University, one of the foremost pioneers in the field of metal electroplating and a former president of the Society.

The Armour Research Foundation will open its doors to visitors on Thursday, and on Friday the Lakeside Press, one of the world's largest, will be open to visitors attending the meetings. Another Friday visitation will be to the South Works of the Carnegie-Illinois Steel Co. to see their electric furnace operations.

Reservations should be made directly with the Hotel, and well in advance, as a large attendance is expected at this affair.

TECHNICAL PROGRAM

Electrodeposition Symposium

Friday, Oct. 14, 2 p.m.

Electrodeposition of Molybdenum Alloys, by *H. J. Seim* & *M. L. Holt.*

Electrodeposition of Copper-Lead Alloys, by *A. L. Ferguson* & *N. W. Hovey.*

Aging Effects in Copper-Lead Alloy Plating Solutions, by *A. L. Ferguson, N. W. Hovey* & *A. Krohn.*

Electrodeposition of Molybdenum from Aqueous Solutions, by *Sister Mary Joecile Ksycki*, S.S.N.D., and *L. F. Yntema.*

Cyclic Phenomena in the Electropolishing of Silver, by *H. T. Francis* & *W. H. Colner.*

Reaction Between Solids—The Formation of Zinc Ferrite from Zinc Oxide and Ferric Oxide, by *D. W. Hopkins.*

Electrodeposition of Bismuth from Aqueous Solutions, by *R. Scott Modjeska* and *S. P. Garry, Jr.*

Saturday, Oct. 15, 9 a.m.

Experiments in Chrome Plating with Radio-Active Chromium, by *A. Brenner* & *F. Ogburn.*

Studies on the Structure of Hard Chrome Plate, by *C. A. Snavely* & *C. L. Faust.*

A High-Efficiency Anode for Alkaline Tin Plating, by *F. A. Lowenheim.*

An X-Ray Method for Measuring Tin Coating Thickness on Steel, by *H. F. Beeghly.*

Deposition of Metals on Aluminum by Immersion in Solutions Containing Fluorides, by *S. Heiman.*

Theory of Rate Processes as a Means of Studying Plating Reactions, by *D. G. Rogers* & *A. A. Burr.*

Clifford A. Hampel
General Chairman

Electrodeposition of Chromium-Tungsten Alloys, by *D. G. Rogers* & *A. A. Burr.*

Conditioning Aluminum Alloys for Electroplating, by *F. Keller* & *W. G. Zelley.*

Corrosion Symposium

Thursday, Oct. 13, 9:15 a.m.

Effect of Adsorbed Polar Organic Compounds on Activity of Steel in Acid Solutions, by *E. L. Cook* and *Norman Hackerman.*

Dr. R. A. Schaefer
Chairman, Electrodeposition Symposium

Sodium Metaphosphate as Corrosion Inhibitor for Iron; Effect of Oxygen and Chloride, by *Herbert H. Uhlig* and *Harry C. Gatos.*

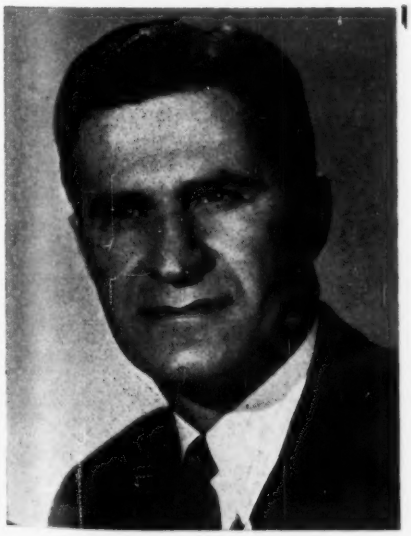
A Unified Mechanism of Passivity and Inhibition, by *R. B. Mears* and *R. H. Brown.*

The Effect of Amines on the Electrode Potential of Mild Steel in Tap Water and Acid Solutions, by *J. D. Sudbury* and *Norman Hackerman.*

The Effect of Oxygen on Inhibition of Corrosion by Nitrate, by *Morris Cohen, Rowena Pyke* and *Paul Marier.*

Thursday, Oct. 13, 2 p.m.

Measurement of the Surface Roughness of Metals, by *Thomas P. May* and *Robert L. Burwell, Jr.*



Dr. Mars Fontana
Chairman, Corrosion Symposium

The Electrochemistry of Stressed Metals, by *M. T. Simnad.*

Chemical Properties of the Intermetallic Compounds Mg_2Sn and Mg_2Pb, by *W. D. Robertson* and *H. H. Uhlig.*

Studies on Galvanic Couples (2 papers), by *H. D. Holler.*

Application of an Electrolytic Probe Technique to the Measurement of Corrosion Currents Underground, by *Walter Beck.*

Friday, Oct. 14, 2 p.m.

Micro Solution Potential Measuring Technique, by *L. W. Smith* and *V. J. Pingel.*

The Dissolution of Aluminum in Sodium Hydroxide Solutions II, by *Michael A. Streicher.*

The Electrochemical Behavior of Aluminum, by *J. V. Petrocelli.*

The Rate of Solution of High Purity Aluminum in Various Bases, by *M. E. Straumanis* and *N. Brakss.*

The Effect of Minor Alloying Elements on the Rate of Dissolution of Aluminum in Bases, by *M. E. Straumanis* and *N. Brakss.*

Electro-Organic Symposium

Thursday, Oct. 13, 9:15 a.m.

Electroreduction of Aromatic Nitro-compounds. Part I. Alkaline Media, by *B. B. Dey, T. R. Govindachari* and *S. C. Rajopalan.* Part II. Acid Media, by *B. B. Dey, R. K. Maller* and *B. R. Pai.*

Electrolytic Reduction of Organic Compounds. Part V. Cathodic Initiation of Vinyl Polymerization in Acrylic Acid, Methyl Acrylate and Methacrylate. Carbonyl Reduction in Crotonic Acid, by *Eugene Dineen, Theodore C. Schwan* and *Christopher L. Wilson.*

Attempts to Prepare sym-Diphenylethylene Glycol from Mandelic Acid, by *Thiessen, Hill* and *Lauterbach.*

The Electrolytic Reduction of Maleic Acid to Succinic Acid in Acid Solution, by *Sherlock Swann, Jr., K. H. Wanderer, H. J. Schaffer* and *W. A. Streaker.*

The Electrochemical Hydrogenolysis of Glucose, by *P. H. Bame* and *N. F. Murphy.*

Performance of Electrolytic Cells in the Reduction of Glucose, by *M. T. Sanders* and *R. A. Hales.*

Electrodialysis of Reduced Keratin Solutions, by *Colin G. Fink* and *Harold Arthur Colle.*

Thursday, Oct. 13, 2 p.m.

Reactions of β-Pinene. III. Electrolytic Oxidation, by *James B. Redd* and *J. Erskine Hawkins.*

Electrochemical Oxidation of Ethanol to Acetaldehyde at Platinum Anodes, by *Bernard O. Heston* and *Sam R. Faris.*

The Oxidation of Ethyl Alcohol and of Chloride Ion at a Platinum Microanode, by *George L. Drury, S. J.,* and *Andre J. deBethune.*

Application of the Dropping Mercury Electrode to Diazo Chemistry, by *R. MacLeod Elofson, Robert L. Edsberg* and *Patricia A. Mecherly.*

The Behavior of γ-Keto and Aldehyde-Acid Derivatives at the Dropping Mercury Electrode. IV. Phthalaldehydic Acid Derivatives, by *Stanley Wawzonek* and *J. H. Fossum.*

Clyde A. Crowley
Chairman, Electro-Organic Symposium

Friday, Oct. 14, 9 a.m.

Studies on Alternating Current Electrolysis. I. The Nature of Polarization Capacity and Polarization Resistance, by *Manuel Shaw* and *A. Edward Remick.*

Studies on Alternating Current Electrolysis. I. Oscillographic Studies, by *Jacob Silverman* and *A. Edward Remick.*

The Polarographic Behavior of Organic Compounds, by *Philip J. Elving.*

Complex Species in Organic Polarography, by *K. G. Stone.*

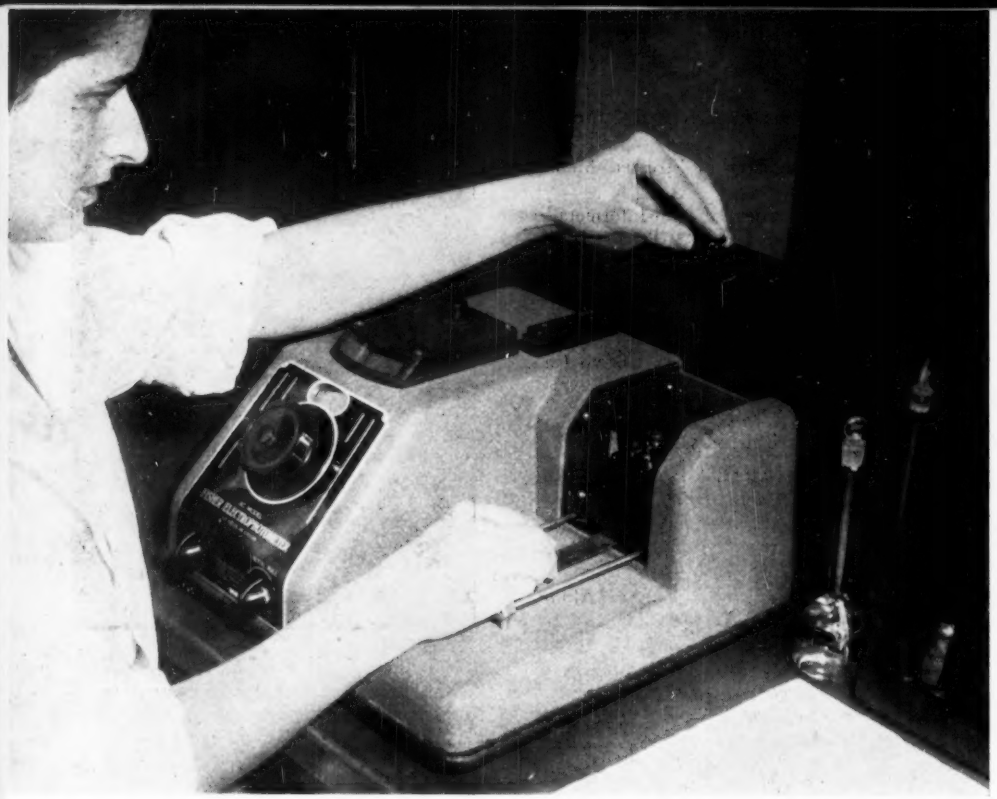
Polarographic Investigation of Mercaptobenzothiazole, by *G. Sartori* and *A. Liberti.*

Prof. F. C. Mathers
Luncheon Guest of Honor

Polarographic Studies on Aliphatic Polyene Aldehydes, by *Melvin Fields* and *Elkan R. Blout.*

Polarographic Studies of Some Hindered and Unhindered Aromatic Nitro Compounds, by *Melvin Fields, Claude Valle, Jr.,* and *Marshall Kane.*

The Mechanism of Electrochemical Reduction of Aryl Ketones and α, β-unsaturated Ketones, by *R. A. Pasternak.*



Colorimetric Methods for the Analysis of Electroplating Baths

By Dr. D. Gardner Foulke, *Electrochemist, Hanson-Van Winkle-Munning Co., Matawan, N. J.*

DURING the past decade instrumental methods of analysis have been widely adopted where rapid control is important. Perhaps the greatest advance has been made in the field of colorimetric analysis. This progress has been marked by the development of simpler procedures and improved instruments. It was inevitable that such methods should be adopted by the plating industry, particularly for the determination of trace constituents which adversely affect the bath operation. Although colorimetric methods may be applied to the routine determinations of major constituents, such methods have not been widely used. However, the fact that major constituents may be so determined if desired, for example, the direct determination of nickel in nickel plating baths, further justifies the installation of colorimetric equipment for analytical work.

Theory of Colorimetric Analysis

The nickel content of electroplating baths has in the past been determined to some extent by a simple colorimetric method which depends upon visual comparisons with standard solutions in a manner similar to colorimetric pH determinations. With the advent of modern photocells it has been possible to cancel out the whole human equation by substituting an electronic tube for the eye, just as it has been possible to

THE AUTHOR

Dr. Foulke is widely known to the plating industry through his numerous writings and talks. A graduate of Juniata College, he obtained his Master's and Doctor's degrees at Rutgers. Since 1941 he has been actively engaged in chemical and electrochemical research in the plating and steel industries, and at present is Chairman of one of the AES Research Project Committees. He has been awarded the AES Gold Medal for outstanding writings in the plating field.

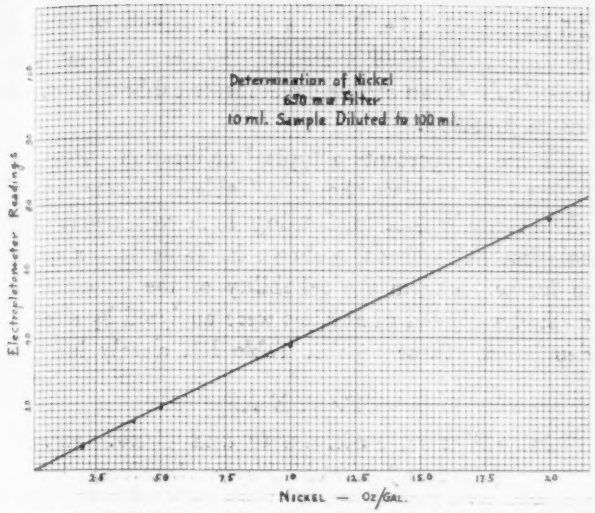


Figure I—Calibration curve for colorimetric determination of Nickel.

substitute a glass or other indicating electrode for the eye in pH measurements.

Colorimetric measurements depend upon the principle that in solutions containing a colored constituent, the intensity of color is directly proportional to the concentration of the constituent. When a beam of monochromatic light* is passed through such a solution, a certain amount of the light will be transmitted, and a certain amount will be absorbed, depending upon the concentration of the constituent being measured. If this transmitted light is directed to a photocell,** the response of the photocell tube can be measured by a galvanometer or a microammeter to give a value which is directly proportional to the concentration of the constituent being determined. Space will not permit the mathematical derivation necessary to show that the relationship is a logarithmic function,[1] but this is unnecessary since the instrument (Fisher) used in this investigation is calibrated to permit the direct plotting of electrophotometer readings against concentration. The manipulation of the instrument, which has been described in detail,[2] is rather simple in that the monochromatic (filtered) light is passed through a "blank" or distilled water contained in an absorption tube or cell at the rear of a sliding carriage and allowed to impinge upon a photo-tube to obtain a zero reading, which is considered to be equivalent to 100% light transmission. Another tube containing a solution of known concentration is then shifted into position and a second reading is taken. This operation is repeated for several known concentrations from which a calibration curve is obtained by plotting the readings against concentrations. The reading obtained when substituting an unknown solution for the standardizing solution can be directly translated to concentration from the prepared straight line as shown in Figure 1.

In the more refined instruments the wave length range of the light passed through the solution is adjusted to a fairly narrow value by means of prisms or diffraction gratings. However, a relatively narrow band of light may be obtained by inserting one or more filters between the light source and the solution. This band of light must be carefully selected from the standpoint of maximum light absorption and possible effects of other ions in the solution. Since cobalt ions are commonly present in nickel solutions, particularly in baths routinely analyzed in our laboratories, a filter was selected which would minimize the effect of the color of the cobalt ion as shown in Figure II. Since the greatest absorption occurs for the cobalt ion at 510 mμ, a filter corresponding to a wave length range near 650 mμ was selected as causing less error than, for example, a 525 mμ filter.

Determination of Nickel in Nickel Plating Baths

Although the determination of nickel in electroplating baths using the conventional sodium cyanide titration method can be both rapid and accurate, the use of the colorimetric method herein described is more rapid and probably more accurate in routine work where standard sodium cyanide solutions are apt to deteriorate, and burettes are even more apt to loose their "water-break-free" properties.

No analytical data for the direct determination of nickel in electroplating baths have been published, although in one instance a colorimetric method was recommended.[3] The method finally adopted is quite simple. As is common practice, a sample of the nickel plating bath is first filtered through a qualitative filter paper. After cooling to room temperature if necessary, pipette a 10 milliliter sample into a 100 milliliter volumetric flask and dilute to the mark with distilled water. Rinse an electrophotometer absorption cell with the solution, refill the cell and place in the forward position of the electrophotometer. Using distilled water in the rear cell and a red filter (650-A), set the instrument at zero. Move the cell carriage backwards so the cell containing the unknown (or standardizing

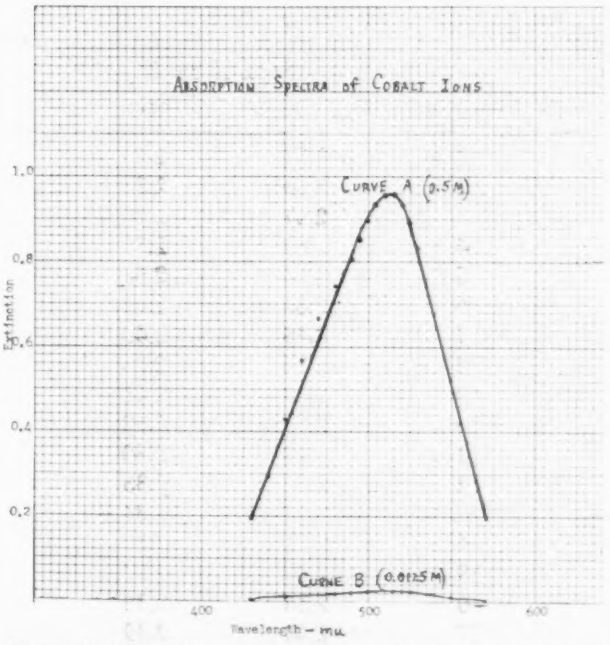


Figure II—Absorption of interfering cobalt color by means of filters.

* *Monochromatic light differs from ordinary "white light" in that white light is composed of light of many colors, or wave lengths, whereas monochromatic light is light of one color, having a single or very narrow range of wave lengths.*

** *A photocell, with its auxiliary electronic circuits, is a device for measuring the intensity of light.*

TABLE I

Data for Calibration Curve for Nickel Determination

Nickel Concentration oz./gal.	Colorimeter Reading 650 Mμ Filter
2	7.00
4	14.6
5	18.6
10	37.6
20	76.0

solution) slides into position and read the percent light transmittance on the log scale. Take the average of several readings for better accuracy, then read the normality or ounces per gallon of nickel directly from a curve previously prepared by following the above procedure and substituting a solution of known nickel content for the unknown sample.

In the interest of clarity a few comments on the method of preparing the standard curve is in order. It is suggested that a liter sample of the nickel bath be taken (or a laboratory sample be prepared of about the same composition) as a standard solution. This solution should be accurately analyzed and set aside to be used as a check on the calibration every three to six months. Data for the curve are obtained by diluting ten milliliters of the standard solution to various volumes to obtain three to five points on the curve. This is equivalent to using various pipettes and taking samples of different sizes, but it has been found that greater accuracy can be obtained using one pipette for all work, both for standardizations and analyses. This pipette should be marked and kept clean and, if dilutions are taken equivalent to 20 ml., 10 ml., 5ml. and 2.5 ml. samples, i.e. dilute a 10 ml. sample to volume in 50 ml., 100 ml., 200 ml., 250 ml., and 500 ml. volumetric flasks, an extremely accurate calibration curve can be prepared.

TABLE II

Colorimetric vs. Volumetric Nickel Determination

	Nickel Normality	
Sample	Volumetric	Colorimetric
1	2.57	2.59
2	2.40	2.37
3	2.47	2.46
4	2.39	2.36
5	2.54	2.56
6	2.44	2.42
7	2.45	2.46
8	2.33	2.36
9	2.39	2.41
10	2.53	2.52
11	2.49	2.50
12	2.3	2.35
13	2.35	2.34
14	2.34	2.36
15	2.50	2.52
16	2.36	2.36
17	2.40	2.39
18	2.37	2.40

Figure I represents a typical calibration curve obtained from the data shown in Table I. A comparison of the results obtained using both volumetric and colorimetric methods is shown in Table II. In order to further confirm the reliability of the colorimetric method a number of samples were analyzed by electrodeposition. These results, Table III, clearly indicate that the colorimetric method is satisfactory for control purposes.

TABLE III

Colorimetric, Volumetric and Gravimetric (Electro) Nickel Determinations

		Nickel Normality		
Sample	Determination	Volumetric	Gravimetric	Colorimetric
1	A		2.44	2.46
	B		2.43	2.43
	Average	2.45	2.44	2.45
2	A		2.54	2.53
	B		2.54	2.54
	Average	2.53	2.54	2.54
3	A		2.31	2.32
	B		2.30	2.31
	Average	2.33	2.31	2.32
4	A		2.37	2.39
	B		2.38	2.39
	Average	2.38	2.38	2.39
5	A		2.43	2.41
	B		2.43	2.41
	Average	2.40	2.43	2.41
6	A	2.30	2.31	2.33
	B	2.30	2.32	2.31
	Average	2.30	2.32	2.32
7	A	2.32	2.27	2.23
	B	2.32	2.27	—
	Average	2.32	2.28	2.23
8	A	2.28	2.22	2.23
	B	2.28	2.23	2.23
	Average	2.28	2.22	2.23
9	A	2.32	2.32	2.33
	B	2.32	2.32	2.33
	Average	2.32	2.32	2.33
10	A		2.34	2.34
	B		2.34	2.34
	Average	2.32	2.34	2.34

In view of the rather consistant results obtained, a complete investigation of all variables was not attempted. Using 10% sodium sulphate as diluting solution gave results identical with those obtained using deionized or distilled water. The effect of changes in acid concentration greatly in excess of anything possible in nickel bath analyses was shown a number of years ago when certain nickel solutions were regularly controlled by colorimetric methods. Table IV indi-

TABLE IV

Effect of Acidity on Colorimetric Determination of Nickel

Normality of Bath in Terms H_2SO_4	Normality After Dilution	Nickel Normality Electro-deposition	Nickel Normality Colori-metric
1	.5	0.196	0.201
1	.3	0.196	0.201
1	5.5	0.196	0.203

cates that an eleven-fold increase in acidity has only a minor effect on the results.

The analytical work represented by tables II and III and IV was done on a series of baths of very similar composition, i.e. the results represent control data. In order to demonstrate the reliability of the method for various baths, samples of a number of different baths, which were analyzed routinely by the sodium cyanide method, were checked by the colorimetric method with the results shown in Table V. These baths varied rather widely in chemical composition, pH, etc., but the results show that wide variations may be tolerated.

This colorimetric method for nickel is simple, rapid and certainly accurate enough for control purposes. Savings in time, standard solutions and the very considerable amount of diluting solution used for routine nickel determinations will justify the initial cost of a colorimeter. Once the colorimeter is available, analyses now done by other methods or not done at all because ordinary methods are not applicable, will be done colorimetrically. These analyses may be for minor constituents, such as cobalt, or for a host of trace constituents for which methods have been developed under Project No. 2 of the *American Electroplaters' Society*.

Colorimetric Determination of Cobalt in Nickel Plating Baths

The use of cobalt as a grain size refiner for nickel deposits has been employed for many years and there are indications that this practice will be extended further. Since the volumetric methods for cobalt are cumbersome and lacking in accuracy, the use of colorimetric methods provides a rapid, simple answer to this problem.

TABLE V

Determination of Nickel by Colorimetric and Volumetric Methods in Baths of Various Types

Bath	Type	Volumetric oz./gal.	Colorimetric oz./gal.
1	9H, low pH	13.9	14.0
2	9H	8.9	8.94
3	Watts	4.8	4.90
4	Organic	4.0	3.94
5	9H	12.9	12.80
6	9H	11.8*	11.25

*A gravimetric (electro) analysis gave 11.25 oz./gal.

The method of *Hixson* and *McNabb*[4] has been found to be quite satisfactory for the routine control[5] of cobalt in cobalt-nickel solutions and the procedure followed by our laboratory is as follows:

1. Place a 10 ml. sample of nickel bath in a 500 ml. volumetric flask, dilute to mark, and mix thoroughly.
2. Pipette a 10 ml. aliquot into a 100 ml. beaker. Use a 5 ml. or a 3 ml. aliquot if necessary to keep the electrophotometer reading below 50, multiplying by 2 or 3⅓, respectively, to get proper concentration if a 10 ml. sample was used for standard curve.
3. Add 10 ml. of sodium acetate solution (500 gm./l.).
4. Add 10 ml. of Nitroso-R salt solution (5 gm./l.).
5. Heat to boiling and carefully add 5 ml. of nitric acid (15 N). Boil for 1 minute.
6. Cool, transfer to 100 ml. volumetric flask and dilute to mark.
7. Measure transmittance at 525 mμ against a blank solution treated the same way, but free of nickel bath.
8. Determine cobalt concentration from a curve previously prepared in which known amounts of cobalt were added under Step No. 1 before diluting to 500 ml.

TABLE VI

Data for Calibration Curve for Cobalt Determination

Mg. Cobalt added to 10 ml. bath	Cobalt in Bath mg.	Total Cobalt mg./10 ml.	Colorimeter Reading
0	1.6	1.6	11.5
1	1.6	2.6	18.5
2	1.6	3.6	26.0
4	1.6	5.6	40.0
6	1.6	7.6	53.0

Since it is difficult to obtain nickel salts free of cobalt, a typical bath was made up to contain 240 grams of single nickel salts, 30 grams of nickel chloride and 30 grams of boric acid as a standard solution. The cobalt content was carefully determined and then varying amounts of cobalt were added under Step No. 1 as shown in Table VI to give the curve shown in Figure III. Samples of nickel baths were analyzed for cobalt and then additional cobalt sulphate was added to yield the results shown in Table VII. It is apparent that the volumetric method is unreliable at lower concentrations and that the accuracy of the colorimetric method is better than the volumetric (perborate-iodide) method at all concentrations, as shown for those samples to which 0.11 oz./gal. of cobalt sulphate was added. These results show that the method leaves little to be desired from the standpoint of control work, particularly when only 15 minutes are required for this analysis.

Large amounts of iron will interfere, but generally bright nickel baths are operated at low iron concentration, so that this metal will not need to be removed.

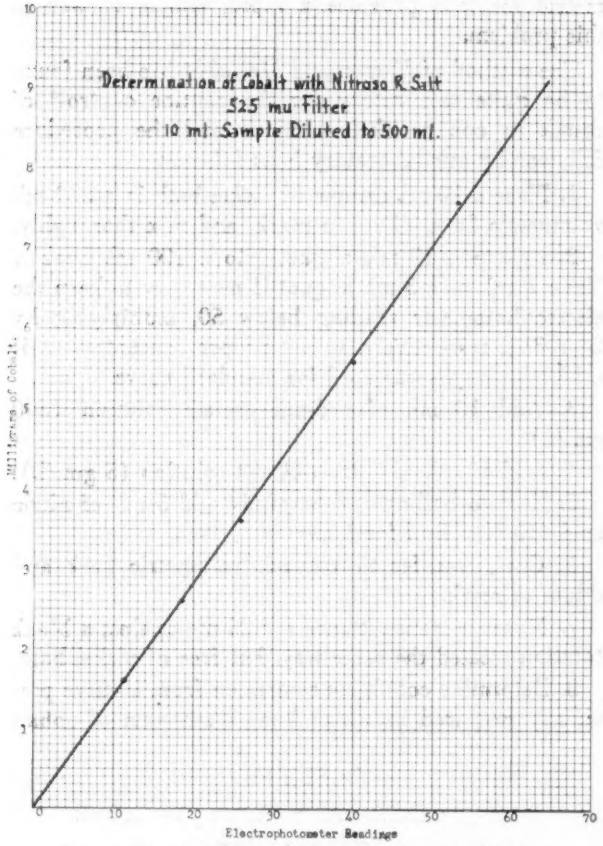


Figure III—Colorimetric Determination of Cobalt.

Determination of Trace Constituents in Nickel Baths

The use of colorimetric methods for determining trace constituents in electroplating baths is an ideal solution to an increasingly important problem resulting from the development of high speed, bright plating operations. A limited amount of work[2] had been reported in this field prior to the time the American Electroplaters' Society authorized the development of methods for the determination of impurities in electroplating baths in 1945. Subsequently, a number of such methods have been published and it is known that many of the methods are currently being employed by plating plants. In the interest of completeness these methods are herewith again brought to the attention of the plating industry in summary form. Since the only published methods are for nickel solutions, this discussion will be limited to such baths, although in the near future a number of methods will be released for copper and zinc baths.

It should be emphasized at the outset that the determination of trace constituents requires special care. When one is determining nickel, the introduction of even 100 parts per million of this metal into the sample at any step in the analysis by poor technique has no effect on the results. However, when determining a concentration of an impurity of 10-100 parts per million, large errors are possible if the work is not done carefully. Laboratory glassware is oftentimes readied for use by means of "cleaning solution" consisting of sodium chromate or chromic acid in sulfuric acid. If one is determining the amount of chromic acid in plating baths, it is evident that very thorough rinsing is necessary to avoid errors.

Determination of Lead

Although lead sulphate has limited solubility in nickel plating baths, the presence of chlorides and organic acids will permit sufficient lead to be dissolved in nickel solutions so as to exceed the bright range and result in brittle, streaked deposits, particularly in the low current density areas. After preparing a standard curve the method for the determination of lead[6] is carried out as follows: A 1 milliliter sample is placed in a separatory funnel and 10 ml. of sodium tartrate solution (10%) is added along with ¼ ml. of ammonium hydroxide. Potassium cyanide solution (5%) is then added to form a complex with interfering ions until the solution becomes light yellow in color, after which the solution is adjusted to a pH 8.5-9.0 with an ammonium hydroxide or a tartaric acid solution. The lead is then extracted as the dithizonate by shaking with several portions of dithizone in carbon tetrachloride (0.006%) and finally with pure carbon tetrachloride, drawing off the solvent layer in each case. The combined extracts, about 15 ml., are then stripped of excess dithizone by washing with 20 ml. of alkaline potassium cyanide solution (10 ml. of 5% cyanide + 5 ml. NH_4OH per liter). The purple carbon tetrachloride layer is now diluted to volume in a 25 ml. volumetric flask, the colored solution is passed through a filter paper (to remove any water) into a colorimetric absorption tube. The reading is taken in the usual fashion with carbon tetrachloride as a reference liquid using a green filter (525 mμ.). This method can be used to determine a few parts per million of lead and upward.

Determination of Iron

The presence of iron in plating baths will cause diverse effects, depending upon the form in which it is found. When present as colloidal or suspended particles roughness will result; when in solution, darkened

TABLE VII

Determination of Cobalt by Colorimetric and Volumetric Methods

Bath	Cobalt Added mg./10 ml. Sample of Bath	Volumetric oz./gal.	Colorimetric oz./gal.
1	0	0.94	0.84
1	2*	0.98	0.93
2	0	0.20	0.053
2	2	0.21	0.16
3	0	0.21	0.11
3	2	0.22	0.22
4	0	0.43	0.44
4	2	0.49	0.55
5	0	1.05	1.02
5	0	1.05	1.03

*Equivalent to 0.026 oz./gal. of cobalt or 0.12 oz./gal. of cobalt sulfate on basis of original bath.

and brittle deposits may be obtained and pitting is apt to occur.

Several methods are available for the determination of small amounts of iron in nickel plating baths. Less care is required when the following method[7] is used. Separate the iron by adding 10 ml. of cold water and 1 ml. of cold cupferron solution (10%) to a separatory funnel containing a 1 ml. sample of the plating bath and extracting with 5 ml. of amyl acetate. Repeat the extraction, combine the separated solvent layers containing the iron cupferride, and release the iron by shaking with 2 ml. of nitric acid (1:1). Draw off the aqueous layer into a 25 ml. volumetric flask and wash the amyl acetate remaining in the separatory funnel by shaking with 5 ml. of water. The "wash" water is also drawn off into the volumetric flask, after which the colored system is developed by adding 1 ml. of hydroxylamine hydrochloride solution (10%), 2 ml. of o-phenanthroline reagent solution (0.25%) and 15 ml. of sodium acetate solution (20%). Dilute to the mark on the volumetric flask and, employing a green filter (525 mμ), measure the transmittance in a colorimeter against water as a standard. A blank should be run in the same way after which the iron concentration can be obtained directly from the calibration curve.

Determination of Manganese

Manganese may be present in plating baths, either from the steel being processed or as the result of certain purification methods, and may cause rough deposits. This condition exists infrequently, so it is sufficient to but briefly summarize the method for the analysis of traces of manganese[8], which consists of a nitric acid-perchloric acid removal of organic and other oxidizable constituents, followed by the oxidation of the manganese to the purple permanganate ion by means of sodium periodate. The intensity of the permanganate color is measured using a green (525 mμ) filter after which the manganese concentration may be determined from a prepared standard curve.

Determination of Copper

The presence of copper in nickel plating baths is not uncommon. This impurity causes rough to spongy deposits, or in lower concentrations, streaked and darkened deposits are obtained on lower current density areas along with a fogging effect where higher current densities obtain. There is a loss in ductility and salt spray resistance of nickel deposits containing copper, and such deposits are difficult to cover with chromium. When determining the amount of copper in a nickel plating bath[9], a 5 ml. sample along with 5 ml. of water are placed in a separatory funnel and 2 ml. of an acetic acid-sodium acetate buffer solution (pH of 3.5) are added. Then add 1 ml. of a 2-mercaptobenzothiazole solution (1%) to form a copper complex which is extracted from the aqueous solution with several 5 ml. portions of amyl acetate. These are combined and thoroughly washed with water after which a colored copper complex is formed *in situ* by adding 5 drops of dibutyl amine and 2 drops of carbon disulfide. The solution is drawn off into a volumetric flask, diluted to the mark with alcohol, and the copper concentration determined against an amyl acetate-ethyl alcohol mixture (2:3), using a blue (425 mμ) filter. A blank should be run as above, except that no amine or carbon disulfide is added and this reading is taken into account when determining the copper content from a previously prepared standard calibration curve.

Determination of Cadmium

It is common knowledge that the presence of 100 to 500 parts per million of cadmium in nickel plating baths acts as a brightening agent. This effect is most pronounced for higher current density areas and oftentimes lower current density areas are characterized by cloudy, streaked deposits which exhibit a loss of ductility and are difficult to chromium plate.

Cadmium may be determined colorimetrically[10] by adding 1 ml. of a cold cupferron solution (1%) to a 1 ml. sample of the bath and extracting the copper and iron complexes formed several times with 5 ml. portions of amyl acetate. The addition of two drops of tartaric acid solution (50%) and 1 ml. of ammonium hydroxide to the aqueous solution is followed by the addition of 1 ml. of mercaptobenzothiazole—ammonia solution (10 ml. of 1% reagent + 10 ml. of 15N NH_4OH + 80 ml. water). The cadmium is then extracted with chloroform several times and, after washing in a separatory funnel with the mercaptobenzothiazole solution (1%) the cadmium is released from the chloroform layer into an aqueous system by the addition of 1 ml. of 6N hydrochloric acid and then determined by forming the colored dithiazone compound which is extracted by carbon tetrachloride and the intensity of this measured in a colorimeter similar to the method described for the determination for lead, except that the pH of the solution from which the cadmium dithizonate is removed is considerably higher.

Determination of Silica

The effect of silica in nickel plating baths is primarily that of causing roughness because of its presence in colloidal or in precipitated form. The increasing use of silicate cleaners may be cause for greater need for silica analysis than in the past.

The method for determining silica[11] simply involves the addition of ammonium molybdate to an appropriate sample, dilution to a given volume, and the measurement of the yellow color caused by the silica-molybdate complex using a blue filter in the colorimeter. The green color of the diluted nickel bath does not interfere.

Determination of Aluminum

The effect of aluminum as an impurity has not been thoroughly investigated. Obviously, the reported instances of increased brittleness, stress and brightness of nickel deposits are not due to co-deposition of aluminum and nickel. It is probable that aluminum in colloidal form accounts for these results and that aluminum in this form or as a precipitate accounts for

(*Concluded on page 67*)

Mechanical Surface Finishing—Tradition or Engineering?

By Ray Kessler, *Pres., Clair Mfg. Co., Olean, N. Y.*

ALTHOUGH the sciences of electroplating and electropolishing have been advancing by leaps and bounds, with too few exceptions progress in mechanical polishing has not kept pace, and where it has kept pace it has been mostly thru the efforts of organizations interested in the manufacture of automatic surface finishing machines. In many modern plants where all other operations are highly mechanized, the traditional hand methods of our forefathers still prevail in the polishing rooms. Although management views the disproportionate size of finishing departments and attending costs with alarm, only in cases of large volumes of parts having favorable geometrical form have operations been mechanized by works engineers. In the past, only those endowed with skill, ingenuity and patience have been successful in producing machines especially applicable to the products concerned. Some readers may take exception to the foregoing, and point to elaborate rotary-table and straight-line machines now available. These are the exceptions already admitted.

Let us make a hypothetical tour through an average plant manufacturing cutlery, industrial jewelry, tableware, surgical instruments, hand tools, decorative hardware, small household appliances and the like. Spend some time in the finishing departments counting

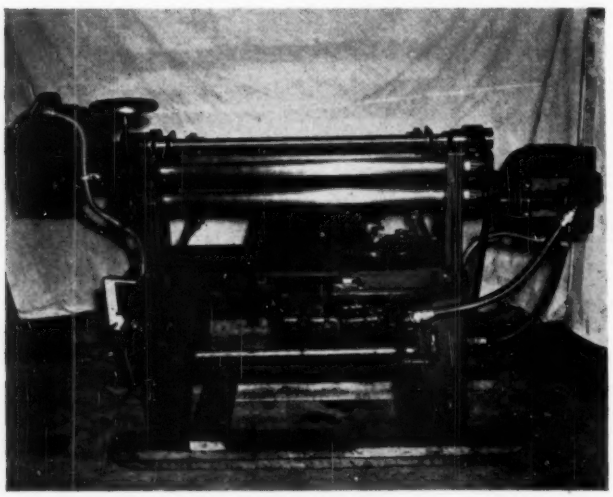


Figure I—The old proven electro-hydraulic mirror polisher which has served as the basic design for recent modifications.

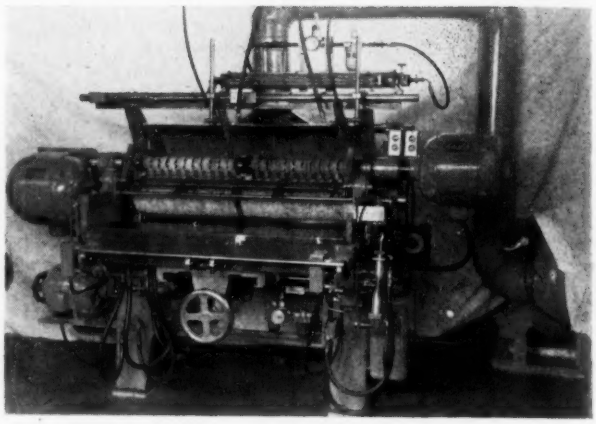


Figure II—By evolution, this Spoon and Fork Polisher can be traced back to the old mirror polisher.

the operators sitting at abrasive belts, hollow grinders, glazing wheels, polishing jacks, and so on. Watch these skilled craftsmen, and we mean skilled craftsmen, apply compounds by hand and obtain the desired surface finish on one item at a time. Enter into conversation with the foremen in these polishing departments and get their slant on buffs, compounds, surface speeds, and traditional techniques each has lived with for a life time. As a last and final step, attempt to correlate hand operating techniques among the various shops with quality standards, as a guide for future reference. Now that you are really and completely confused, go back to these same foremen and challenge some of their traditional "theories" as fallacies. More than one technician has been literally thrown out on his ear or ridiculed to the point of throwing up his hands in despair for having been so brash!

Many a well-designed polishing or buffing machine has been confronted with identical stone-wall resistance. Let us recite a typical example taken from the record.

A concern became interested in a newly designed electro-hydraulic machine. Instead of setting it up under the supervision of a qualified technician for the purpose of exploring its potentials, it was placed on trial in the center of a department employing upwards of a hundred expert hand polishers. The manufacturer's representative, whose questionable pleasure it was to demonstrate the capabilities of his equipment,

was faced with the jeers and challenges of the old school. In fact, he was put on the spot by both employees and management. The craftsmen employed in that department suggested which articles should be tried on the machine. Naturally, they chose the most intricate geometry as the surest challenge, and also because such items are least attractive to hand operators. The foreman went along, on the premise that since the parts having intricate geometry bore the highest piece rate, greatest economies would result by mechanizing the most difficult operations first. None of those parts which would lend themselves more readily to mechanical polishing were tried on the machine because these items usually presented fewer problems to both management and polishers. The

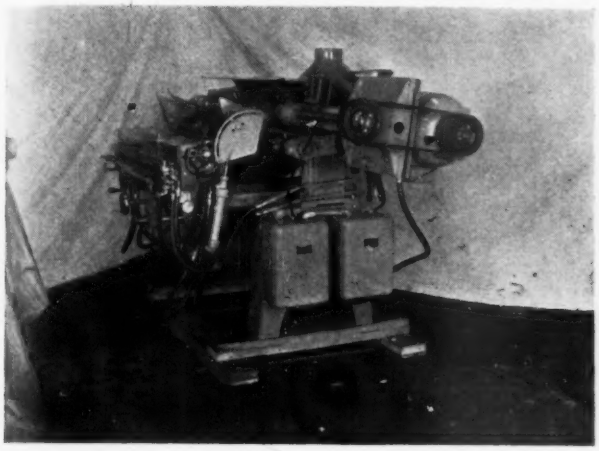


Figure III—Another version of a Spoon and Fork Polisher, note the hydraulically actuated quadrant, etc.

demonstration succeeded in proving but one thing, i e., in competition with this automatic machine, hand operations are a more effective means of obtaining complete coverage over surfaces that exhibit intricate geometry. Accordingly, the machine was appraised as not competitive and hastily removed. However, this example has a sequel, for the same machine was demonstrated to another firm, where a young, enthusiastic engineer took it under his wing. Today that same piece of equipment is producing a uniformly high quality standard six times faster than that of the best hand operator. But—the doors are closed. Not even the manufacturer of the machine has been permitted to see it in operation! While this particular machine is proving its worth, practically nothing has been contributed towards further progress in the general field, due to this short-sighted policy, which is far more common than is generally supposed. Fortunately, the future for mechanical polishing is not completely black. With reconversion in the background, and competitive markets a reality in the business world, it becomes increasingly important that industry carefully weigh every expense involved in production. Wherever surface finishing operations present problems, polishing department costs are being recognized as fertile opportunities for immediate economies. Some of the larger concerns emphasize the crying need for improved mechanical devices in their polishing rooms, and many are going so far as to counsel and assist the manufacturers of automatic machines to that end. In view of economic trends, there is a concerted effort on the part of far-sighted executives to get back on a progressive competitive basis. As a result, the advancement in mechanical surface finishing machines has been accelerated in the past three years and appreciable progress can be reported. The backlog of orders for new equipment is large and sales promotion efforts are temporarily of lesser importance. Instead of sales expenses, funds and time are being invested in development.

As previously stated, works engineers and production experts from the field are playing an important part in current development. A group of these kindred spirits recently outlined the following premises to guide their endeavors:

1. Highly-colored, mirror-like surfaces are not necessarily the most practicable or artistic, and the customer should be educated away from that false conviction.
2. The sound basic fundamentals and principles involved in mechanical surface finishing should be established and publicized in an endeavor to "debunk" the traditional fallacies handed down through generations.
3. Existing equipment designs should be investigated, tested, modified, and improved, as an immediate source of automatic machines.
4. The metal finishing industry should make a detailed study of requirements and develop new machines capable of furthering mechanical finishing operations.

Typical of the type of operation that has been successfully mechanized, the following example will illustrate what can be done when machine manufacturers and production men work hand-in-hand toward a common goal.

One of the first problems to be tackled concerned the mechanical finishing of inside and outside of spoon bowls simultaneously. The problem was complicated by the fact that spoons are made in practically an infinite variety of shapes and designs. Starting with a well known electro-hydraulic double-buff design similar to the one shown in Figure I, it was decided

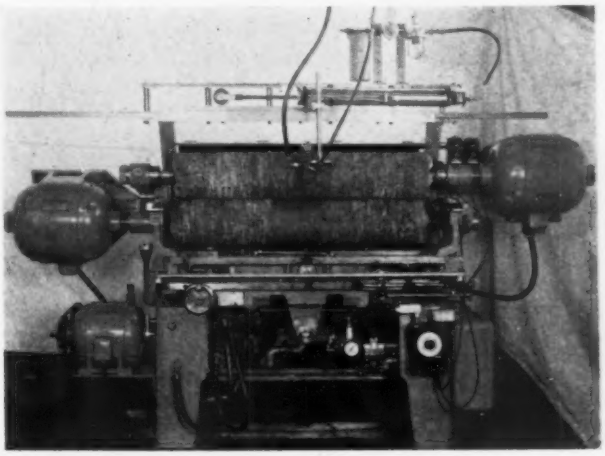


Figure IV—A modern conception of a mirror polisher complete with spray equipment and cycling controls.

to actuate work racks in order to simultaneously expose the inside of bowl to small diameter preformed convex buffs and the outside to large diameter concave buffs. The first attempts involved mechanical actuation with indifferent success. The problem was solved by a quadrant that is hydraulically operated through any part of an 120° arc. This quadrant, mounted on the loading fixture arm, is controlled by a double-acting hydraulic cylinder. Adjustments for spoon bowl depth and length are made by sliding the lock nuts in a groove in the quadrant, by the shape of the loading fixture and the radius of the traverse. Since the length of the traverse cylinder stroke is easily adjustable, spoons of almost any geometry as well as any other concave shape, such as forks, pliers, handles, and the like can be surface finished as easily as a flat surface. Approximately 24 dessert spoons, 28 teaspoons, or 32 dinner forks, constitute a rack load.

There is neither time nor space in this article to describe all recent developments. However, a second instance worthy of comment was in response to an insistent demand for a machine capable of holding industrial jewelry items which require complete coverage. Here non-magnetic materials such as brass, copper, silver and aluminum were involved, making the use of magnetic holding devices impractical. The solution was found in a horizontal electro-hydraulic machine modified by a table consisting of a perforated plate mounted over a sealed air space, this space being connected to a vacuum pump through a 4-way spring-return foot valve. Rubber mats and conforming rubber pads complete the 38″ x 24″ vacuum-chucking arrangement, which has proven convenient and successful to the point where applications have been expanded to magnetic materials and innumerable items. A further modification of this same machine involves the use of a magnetic chuck instead of the vacuum holding arrangement.

In the interest of proper surface speeds, almost all existing electro-hydraulic machine designs employ buffs approximately 9″ in diameter by 40″ wide, which are incapable of getting at numerous small angles and radii encountered on many items. This challenge has been at least partially met by a supplementary single-spindle design incorporating a 42″ spindle ¾″ in diameter supported by a center bearing and direct driven by a reversible high-speed motor. The loaded work racks are interchangeable between the larger machines and this special model where the ¾″ diameter spindle permits the use of small diameter buffs. As an additional feature the side motion on this machine is actuated by an air cylinder which provides high frequency oscillation.

A number of ingenious concerns have been successful in modifying and adapting existing designs to their applications to effect considerable economies. However, where a battery of machines is operated as a unit, additional labor economies become possible through the utilization of automatic timing devices. A number of machine manufacturers attempted to add these controls as accessories. Many of the early installations were admittedly "Rube Goldberg" affairs that, lacking any degree of uniformity, gave a machine a Christmas Tree appearance, and added greatly to maintenance complications. Working with one machine manufacturer, experts have now developed automatic timing controls that do everything but talk. The only drawback is in the fact that, in the interest of rugged simplicity, uniformity and sound engineering, these control circuits must be incorporated as an integral part of the machine during manufacture. In service they are paying their way handsomely as labor saving devices and tend to overcome the element of human error that so frequently affects uniformity of quality.

One reason why the development of mechanized finishing has been slow is the physical hazards encountered in the early designs. Among the first machines was the so-called Mirror Polisher, still widely used by the cutlery industry. It is hardly possible to find a plant using one of these machines which has remained free from accident. The hand application of cake compounds is admittedly one of the most crude and hazardous operations involved, and it is next to impossible to impress and convince a green operator that his reflexes are too slow to keep him out of trouble if he is careless. All kinds of ideas and devices have been tried but accidents still occur. In an effort to combat this condition some polishing rooms enforce safety rules that slow up production as much as thirty percent. While grasping at straws in an effort to remedy the foregoing, one of the most promising developments was being overlooked. Although many of the old school still scoff at the automatic spray method of applying abrasives and compounds to the buffs, many progressive concerns are making it pay dividends in safety, increased production and other operating economies. It promises to become an important adjunct in the future development of mechanized surface finishing.

Due to the numerous variables involved, surface finishing operations afford no common bases for comparative analysis of time study and cost figures. No two manufacturers encounter identical operations, geometry, base metal, rough conditions, techniques and quality standards. Therefore, where performance data credit machines with increased production and

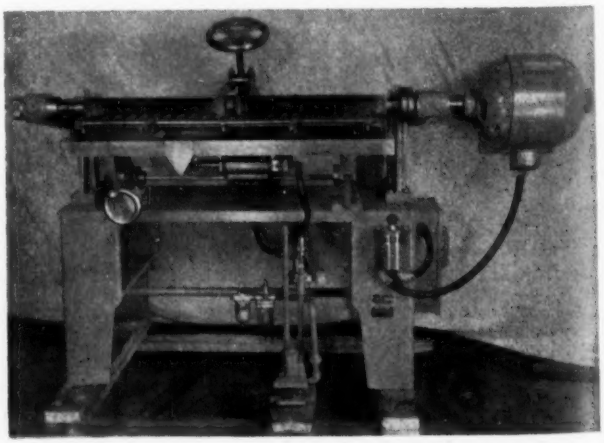


Figure V—A unique design incorporating air oscillation, reversible high speeds, and small diameter buffs.

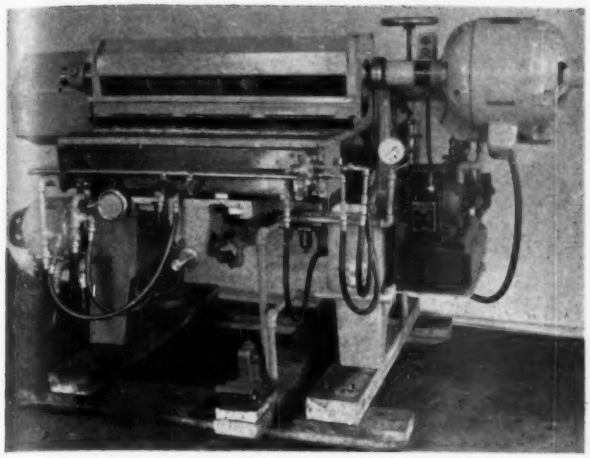


Figure VI—A single spindle design utilizing vacuum chucking.

decreased costs, the information should be weighed on the basis of relative, rather than specific, value. One of the larger and better known users of automatic surface finishing equipment takes full advantage of time study and cost analysis in the interest of optimum efficiency, but summarizes the investment value of a machine in terms of its *annual earning capacity over and above his best previous experience.* This manufacturer credits a spoon and fork polisher, similar to the improved machine first described in this article, with an annual net earning capacity of $22,000 as against hand operations on nickel-silver dessert forks. A large industrial jewelry concern rates a vacuum chucking machine similar to the one previously described in terms of the items being processed, from two to six times more efficient than a hand operator.

Mechanization of surface finishing is still in its infancy. While it is true that a few organized pressure groups may oppose any inroads machinery may make in competition with the old hand methods, these groups may as well recognize that unless their craft keeps pace with the sciences of electroplating and electropolishing, it will die a natural death, sooner or later.

In conclusion, we quote below one of the country's outstanding finishing experts:

"As can be expected of operations in which the human factor plays such a commanding part, Polishing and Buffing have long been submerged in the realm of art. It is encouraging to note that problems in this field are now being approached in a scientific manner. Much fundamental data are still to be uncovered but continuing precise investigations promise ultimately to lift this section of metal finishing to the level of an applied science."

COLORIMETRIC ANALYSIS

(*Concluded from page 63*)

most of the difficulties ascribed to this element in nickel baths, that of rough deposits.

Up to the present time there has been little need for a method to determine aluminum[12] in nickel baths, although with the increased use of aluminum alloys the problem may become more common. The procedure involves the removal of (1) any iron by extraction of the cupferride with amyl acetate and (2) the nickel by extraction of the diethyldithiocarbamate complex with chloroform. The aluminum is then determined colorimetrically by making the aqueous layer slightly acid, adding aluminum (0.5%) reagent and an ammonium acetate buffer, and measuring the color developed using a 525 mμ filter.

Determination of Zinc

Although zinc has been used as a promoter metal in organic bright nickel solutions, it may cause dark or streaked electrodeposits when present in the bath in amounts much exceeding fifty parts per million, particularly in lower current density areas, and the brittleness of the deposit is increased.

The determination of zinc[13] in nickel baths has always been difficult and A.E.S. Project No. 2 found it necessary to develop a new reagent to simplify this determination.

To a 0.1 ml. sample of the nickel bath add 25 ml. of water and 20 drops of cupferron solution (1%) and extract several times any iron or copper cupferride which may form by means of 10 ml. of amyl acetate. To the aqueous layer add 2 ml. of sodium tartrate solution (10%), 25 ml. of water and 10 ml. of the special diethanoldithiocarbamate reagent (30% at pH 8.8-8.9) to complex the heavy metals so that upon the addition of 5 ml. of dithizone reagent only the zinc dithizonate will be formed. As for lead, several dithizone extractions are made and the color of the zinc dithizonate in carbon tetrachloride is finally measured at 525 mμ against carbon tetrachloride and the amount of zinc is determined from a previously prepared calibration curve.

Methods are also available for determining traces of ammonia[14] and potassium[15] in nickel baths, and eventually impurities in other plating solutions can be quickly determined. Certain proprietary organic brighteners are also determined by colorimetric means as has been molybdenum in zinc plating baths in the form of the thiocyanate complex.[16] The use of colorimetric methods has been reported recently by two authors[17, 18] for alloying metals, gold and phosphate. Undoubtedly, other major and minor constituents will be determined by the colorimeter, for example, sulfate in chromic acid baths, all of which would indicate that the colorimeter and spectrophotometer will eventually be an instrument commonly found in plating labs.

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Electrolytic Polishing of Metallic Surfaces—Part V

By Dr. Pierre A. Jacquet, *Ingénieur-Chimiste I.C.P., Docteur de l'Université de Paris, France.*

In the fifth article in this series, the author cites examples to prove that many of the accepted values for surface properties of metals are of doubtful value, due to the fact that the surfaces used in determining such values were poorly defined and not reproduceable.—ED.

Corrosion—Oxidation—Passivation

CORROSION of metals and the phenomena of oxidation and passivation are surface processes, and it is remarkable that very few of the investigators have recognized the tremendous influence of the initial state of the samples used for their experiments. Many of them used surfaces polished mechanically or else chemically etched. All of the results revealed to this point in this article have shown that the microgeometric and physico-chemical characteristics of surfaces prepared in such a way are poorly defined and not reproduceable.

We will give a few examples which will show the wide differences determined on surfaces of the same metal polished either mechanically or electrolytically, which will make evident the interest in this new method of finishing.

Oxidation of Aluminum

The work of *Chaudron* and his associates on the solution potential of aluminum, and the more recent research of *Raether,* show that the measurement of this potential constitutes an extremely sensitive method for the detection of very thin films of aluminum oxide formed on contact with water or air. *Chaudron, Lacombe* and *Morize*[34, 39] have thus been able to follow the oxidation of very pure aluminum exposed to different media. They have shown the catalytic effect of water vapor on the speed of formation of the film of oxide in air at room temperature (Figure 32).

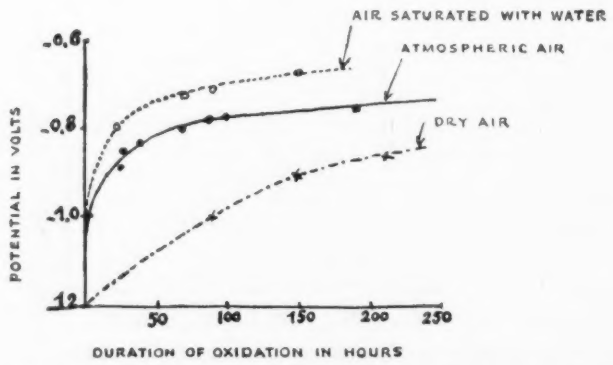


Figure 32. Variation of solution potential of aluminum surfaces electropolished (measured in distilled water) as a function of the time exposed to humid or dry air.

It has already been noticed that the results of *Raether* have been interpreted by admitting that the oxide layer formed very quickly on the surface of electrolytically polished aluminum, giving films 30 to 50 A° thick, but which increase slowly from that point on. This layer is quite continuous and should play an efficient part in protecting the surface from corrosion. Such a conclusion is shown by practical experiments which will be discussed later. Oxide films formed on electrolytically polished surfaces (aluminum, zinc) have started numerous investigations.[40]

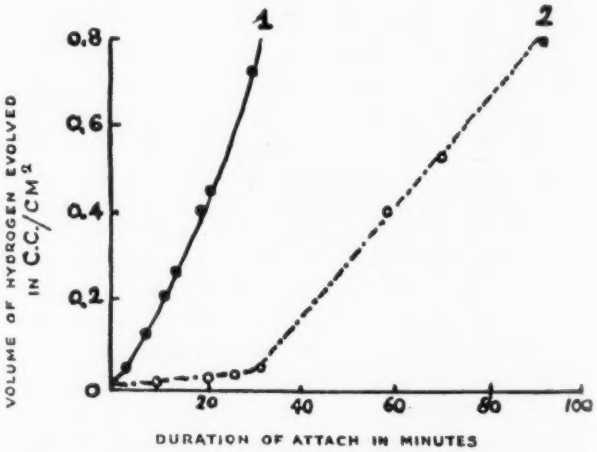
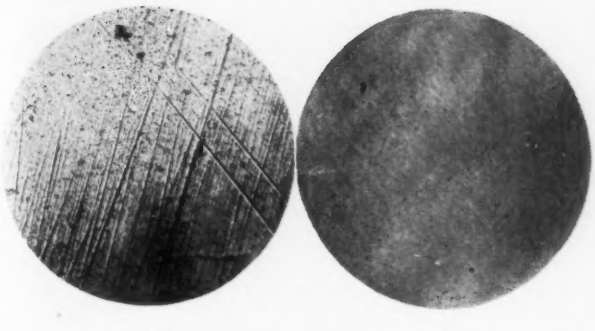


Figure 33. Comparison of the speed of corrosion (determined by measuring the volume of hydrogen evolved) of aluminum immediately after electropolishing (Curve 1) and after oxidation in air (Curve 2) in 10N hydrochloric acid. Curve 2 shows an induction period of 30-35 mins. during which corrosion is negligible.

Solution of Aluminum in Acids

It is known that metal deformed by cold working is more reactive than the same metal well crystallized. Now it is easy to see that mechanically polished aluminum, in which the surface structure is disturbed, is less quickly attacked in hydrochloric acid than alumi-



A B

Figure 34. Surface of aluminum samples of 99.99% purity for corrosion in caustic, salt spray, and exposure to outdoor atmosphere test. Magnifications 360x.
a) Mechanical polishing with a buffer (industrial polishing).
b) Electropolished (acetic-perchloric bath).

num immersed in the acid immediately after removal from a polishing bath. This difference in initial speed of solution originates in the oxide film with which the mechanically polished surface is covered. It is actually sufficient to oxidize anodically-polished aluminum by exposure to the air in order to see the induction period characteristic of the state of the mechanically polished surface (Figure 33). The intergranular corrosion of polished aluminum in hydrochloric acid has been studied from a micrographic view point.[41]

Solution of Aluminum in Caustic

The attack of the surface of 99.90% pure aluminum in a 4 g/l solution of NaOH has been studied.[42] Knowing that the metal dissolves very quickly in sodium hydroxide and that alumina is equally soluble, one might think that the microgeometric and physicochemical properties of the surface would only play a very small role in the processes of solution.

Samples were polished on a cloth coated with an industrial polishing paste, then carefully degreased. Some of these were then electrolytically polished for four minutes, either in an acetic-perchloric bath or a commercial phosphochromic bath.[24] Figures 34a and 34b show the surface appearance of the specimens receiving mechanical or electrolytic polishing.

It has been established that mechanically polished aluminum is more rapidly dissolved at first, and then the speeds of attack become comparable (Table II), but the external appearance of the samples remains quite different for an appreciable time. Mechanically polished aluminum quickly loses its ability to reflect and becomes dull, while the electrolytically finished surfaces remain brilliant (Figure 35).

TABLE II

Influence of the state of the surface on the speed of solution of aluminum in caustic

State of the surface	Weight loss (mg/cm²) in 4 g/l NaOH at 17-18°C., for successive periods of two hours each. 1st period	2nd period	3rd period	4th period
Mechanically polished	1.10	1.30	1.10	1.06
Electrolytically polished (acetic-perchloric bath)	0.71	1.07	1.20	1.02

Examination of the corroded surfaces shows two different appearances. The mechanically polished sample corrodes to give etch figures of a round form (Figure 36) which reflect light in all directions and thus are matte. On the contrary, solution is quite even on an electrolytically polished surface and results in an appearance related to the structure of the metal (Figure 37).

Interesting information is contributed by alkaline corrosion of sheets of aluminum on which scratches have been made with a fine steel point. The metal used is 99.90% semi-hardened aluminum (cold rolled after annealing). The scratched surfaces after mechanical polishing show corrosion in nodules at all points (Figure 36). The same specimens electrolytically polished after scratching show preferential corrosion in the scratches (Figure 37). Similar experiments were run with the same aluminum annealed three hours at 340° C. after mechanical polishing. With or without new mechanical polishing the surfaces are attacked in caustic and give typical nodular corrosion as shown in Figure 36, which appearance remains the same whether the artificial scratches are made before or after annealing. If the scratched surfaces are annealed and then electrolytically polished the corrosion is uniform at all points and shows the crystal structure of the metal (Figure 38). In the case where the surfaces are scratched after, rather than before annealing, then polished electrolytically, the corrosion in the scratches is more intense than in the unscratched surfaces (Figures 39 and 40), and shows the structure of the crystals disturbed by the mechanical action.

These results show that the more intense attack in the bottom of the scratches in aluminum is not due to the destruction of a protective film or an effect of differential aeration, but simply proves the cold hardening of the metal crystals. This conclusion stands out well in a comparison of Figures 38 and 39. The fact that this difference does not appear on mechanically polished pieces which are always attacked in nodules is a result of the fact that all of the surface possesses the same physico-chemical properties (disturbed crystal structure, oxide film and chemical impurities resulting from the polishing agents). It should be noted that annealing at 340° C. does not change these superficial properties. However, annealing should destroy the cold working. One would then assume that the layer of chemical impurities (principally oxide) plays

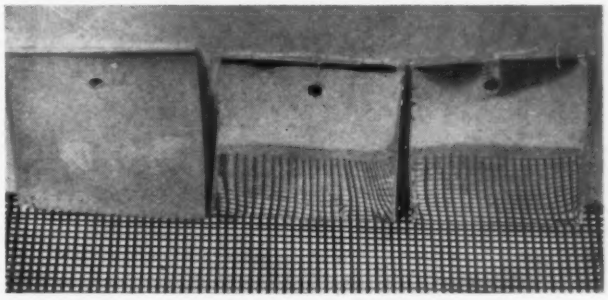
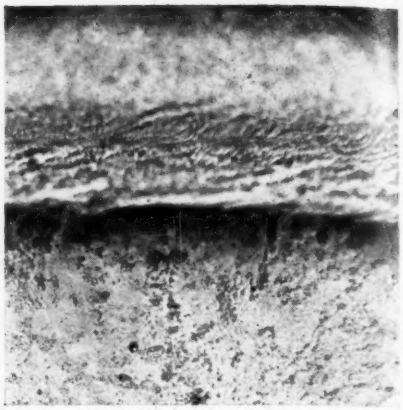


Figure 35. Plates of 99.99% aluminum sheet. Corrosion in 0.1N caustic soda solution for 5 hrs. at 11-12°C. Left to right—Mechanically polished, electropolished in a commercial bath, electropolished in a perchloric-acetic bath.

(At left)

Figure 36. Mechanically polished aluminum. Surface of the sample after 2 hr. attack in 4 gm/l. NaOH. Arrow indicates the side of an artificial furrow.



(At right)

Figure 37. Electrically polished aluminum. Surface of the sample after 2 hr. attack in 4 gm/l. NaOH. Arrow indicates the side of an artificial furrow.

a more important role. However, if an electrolytically polished surface is covered with a thick layer of oxide by anodic oxidation, then immersed in a solution of sodium hydroxide, first a solution of this layer without gas evolution is observed, then the corrosion of the metal proceeds in a regular manner with gas formation, without the appearance of the characteristic patterns of corrosion on mechanically polished material. Overall, the appearance of the corroded surface is absolutely similar on electrolytically polished surfaces whether or not they are oxidized, or in other words, the layer of oxide does not play any part. Thus, in order to explain the singular appearance of the corrosion of mechanically polished aluminum and also that gas is formed upon immersion, it is necessary to assume that the polishing layer is formed of an agglomerate of small crystallites, produced by cold work, surrounded by oxides. This layer does not undergo any modification during annealing, the recrystallization of the metal probably being retarded by the presence of the oxide separating the microcrystals. This layer is removed at the start of electropolishing in the form of a very dull film which is detached from the surface and falls to the bottom of the tank. The metal being thus laid bare it is possible to study the real processes of corrosion.

It should be remembered that the above results refer to 99.90% pure aluminum. Metal of ordinary quality (99.5%) does not show the differences between mechanical and electrolytic polishing as clearly. Actually, from the start of caustic corrosion the electrolytically polished surface loses its ability to reflect, or it is attacked in the same way as mechanically polished samples. The impurities, even at percentages as low as 0.4% thus have a more important effect on the properties than the microgeometric or physico-chemical characteristics of the surface.

Corrosion of Aluminum in Natural Media

The study of the corrosion of aluminum in alkaline solutions is interesting from a scientific viewpoint but is of no great practical value. It is much more important to observe the behavior of the metal in natural media.

From tests in outside atmosphere and salt spray, again considerable differences between 99.90% aluminum polished mechanically or electrolytically have been established.[43] Thus, after 120 hours in a salt spray (30 g/l NaCl) electrolytically polished surfaces remain bright and only show slight accumulations of oxide, while the mechanically polished specimens are covered with a thick crust of oxide (Figure 41). Microscopic

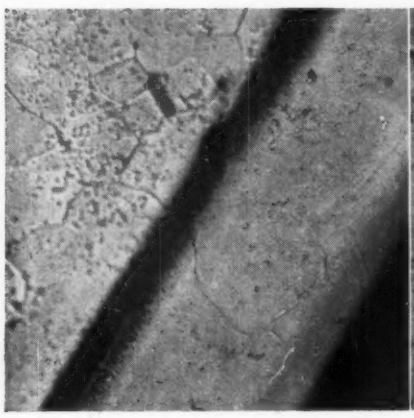


Fig. 38

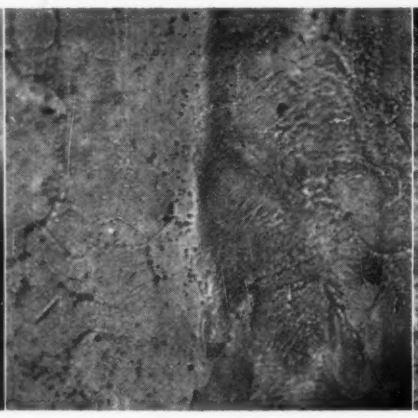


Fig. 39

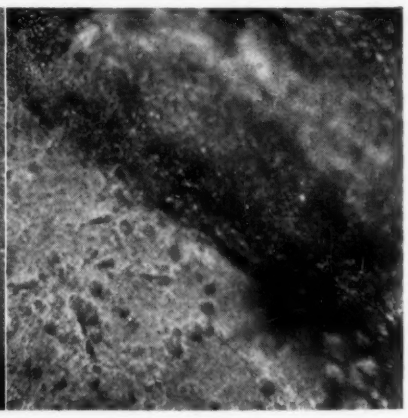


Fig. 40

Figure 38. Scratched aluminum annealed 3 hrs. at 340°C. and electropolished. Appearance after 2 hrs. corrosion in 0.4N NaOH. 360x.

Figure 39. Aluminum annealed 3 hrs. at 340°C., scratched, then electropolished. Appearance after 2 hrs. corrosion in 0.4N NaOH. 360x.

Figure 40. Same specimen as Figure 39 after 8 hrs. corrosion in 0.4N NaOH. 360x.

examination of the corroded surfaces (Figures 42a and 42b) tends to prove that the greater resistance of the electrolytically polished surface is due to the perfect continuity of the very thin film of alumina which is formed immediately on contact with air. In the case of the mechanically polished surface, the presence of fine striations and surface chemical impurities impairs the continuity of the oxide film. Besides, the fragmented crystals produced by the cold deformation which accompanies mechanical polishing are certainly more easily corroded than undisturbed crystals. In other words, the passivation acquired by aluminum on contact with the air is more complete on the electrolytically polished specimens than on the mechanically polished specimens. We will see that these phenomena are also observed with brass and stainless steels.

The influence of impurities on the corrosion of aluminum is easy to study on electrolytically polished surfaces. Thus *Rocquet* has shown that the perforation of ordinary aluminum sheets containing iron and silicon is caused by preferential attack on the ternary eutectic Al-Al_4FeSi_2-Si in media containing an organic acid.[44] This attack is visible by observation of an anodically polished specimen under the microscope, in contact with corrosive liquids having the same pH as some natural media encountered in preserved foods.

Corrosion of Brass

Present practice indicates that alpha brass (70% Cu-30% Zn) exposed to the atmosphere preserves its reflecting power much better when the polish has been obtained by the electrolytic method. Investigations undertaken in France by the "Commission des Etats de Surface" under the direction of *Ballay* have confirmed this commonplace observation.[43] These studies have also shown that in very corrosive media (nitric acid, ammonia) the ability to reflect, measured by means of a photoelectric apparatus, is preserved much longer if the surface has been polished in orthophosphoric acid even though the speed of solution is identical or even more rapid than that of mechanically polished specimens (Table III).

We thus find with brass the phenomenon already described for aluminum: electrolytic polishing does not appreciably alter the speed of attack but the process is quite different from that observed on a mechanically polished surface, since the loss of reflectance is much slower. One may assume that on a mechanically polished surface the chemical reagents produce multiple facets of corrosion possessing all orientations, from whence comes the rapid lowering of the reflecting powers, while on a surface electrolytically polished the solution is more homogeneous. The cause of this difference is without doubt the disturbed layer which characterizes the surface structure of the mechanically polished state, the presence of which has been shown, (Figures 13 and 19).

Corrosion While Hot

Dry corrosion of metals and alloys is a very important phenomenon in practice and this also depends upon the state of the surface of the material. However, few of the investigators have taken into account the microgeometric and physico-chemical aspects of the samples destined for experimentation.

Chevenard & Wache noticed that the kinetics of oxidation of an austenite (nickel-chrome) differs, depending on whether the surface was abraded with emery paper or polished electrolytically: in the latter case the reproducibility is much better.[45] Appreciable differences have also been established in the hot oxidation of iron and copper.[46]

Vernon and his collaborators[47] have established that the increase in weight of zinc heated in air is not the same, according to whether the surface had been polished by one or the other of the two processes: it is much less in the case of an electrolytically polished surface. The layer of oxide which always exists on mechanically polished zinc and which is eliminated during electrolytic polishing in caustic, modifies the process of the reaction. *Vernon* showed the presence of an oxide film on mechanically polished zinc by subjecting the sample to heat at high temperature under

TABLE III

Variation of reflecting power and speed of solution of brass (polished mechanically or electrolytically) in nitric acid or aqueous ammonia.

Nature of Surface	Corrosive Medium	Duration of the Experiment in Hours							
		2 hr.		3 hr. 20 min.		5 hr. 20 min.		8 hr.	
		W. L.	R. L.	W. L.	R. L.	W. L.	R. L.	W. L.	R. L.
Mechanical polishing	10% HNO_3	3.5	82%	5.0	85%	7.0	95%	11.0	95%
Electrolytic polishing	10% HNO_3	5.0	37%	7.0	44%	12.0	55%	15.0	67%
Mechanical polishing	10% NH_4OH	1.5	60%	4.0	75%	6.5	81%	9.0	85%
Electrolytic polishing	10% NH_4OH	2.5	33%	4.0	39%	4.0	41%	7.5	46%

W. L. is weight loss in mg. per sample
R. L. is reflection loss in % of original ability to reflect

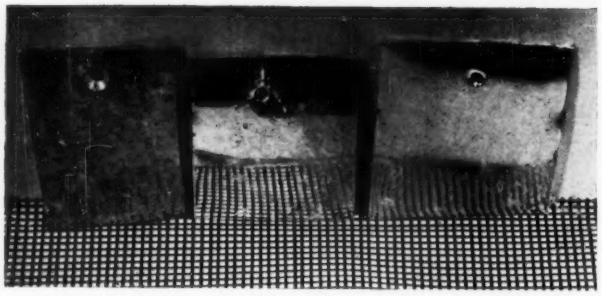


Figure 41. Sheets of 99.99% aluminum after salt spray corrosion (30 gm/l. NaCl) for 120 hrs. Left to right—Mechanically polished surface, electropolished in perchloric acetic bath, electropolished in an industrial bath.

vacuum: the zinc distilled left a residue which was the surface oxide. This residue does not appear if the surface has received an anodic polish in caustic soda.

Gwathmey & Benton showed that the faces of an electrolytically polished monocrystal of copper showed different speeds of oxidation, depending upon their orientation,[48] a phenomenon which is related to the studies of the same authors on the electrochemical reactivity of monocrystalline copper and on its catalytic properties.

For the study of the corrosion of refractory alloys at high temperatures, it is practical to polish the surfaces submitted to the tests electrolytically, for these alloys are frequently difficult to polish mechanically. In addition, the electrolytic preparation has the advantage of always giving reproducible surface states.[49]

Passivation

The absence of micro irregularities, disturbed layer, and chemical impurities, which is characteristic of electrolytically polished metallic surfaces, is an eminently favorable factor in the passivation of these surfaces on contact with the air or some chemical reagents. We have already seen an example with aluminum, which is covered with a film of oxide or an adsorbed layer of oxygen of 20 to 30 A° thickness, either in the polishing bath itself, or in the first instant of contact with air, sufficient to assure a remarkable protection in those media where this passivation is stable.

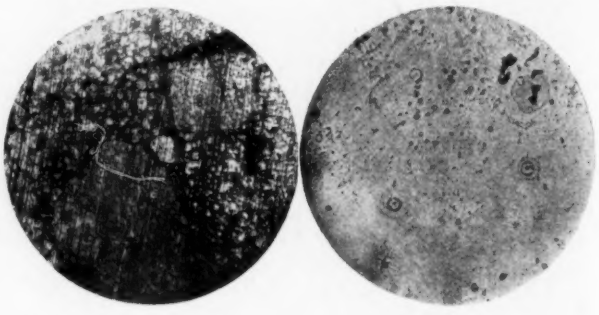
Another example is that of austenitic nickel-chrome stainless steels. *Pray & Faust* are the first to show the passivation of these alloys polished in industrial baths,[50] while the mechanically polished specimens are subject to a more or less rapid corrosion. It is probable that the passivation is produce directly in the course of electrolysis. *Guitton* has shown that efficient passivation of stainless steel is connected with etching, the role of which is the elimination of cold working heterogeneities from the surface, these heterogeneities being able in effect to be transmitted to the passive film and reducing its stability.[51] Anodic polishing provides precisely the means of realizing this essential primary corrosion. *Guitton* compared the two micrographic polishing methods on 18—8 steel: mechanical polishing with emery paper and aqueous suspensions of alumina, and the electrolytic method. The mechanically polished samples gave irregular results in 10% hydrochloric acid, for the steel was able to acquire a certain degree of passivation on contact with air and water. Immersion in 10% nitric acid invariably gives preferential attack on the polishing striations, which proves that the protective film is either not formed or is destroyed at the site of the cold deformed regions. Quite the contrary, electrolytic polishing confers a passivity which is complete in the presence of nitric acid: the surface completely retains its initial brilliance.

The Phenomena of Ion Exchange

The technique of radioactive tracers makes it possible to study the exchange phenomenon between a metal and a solution of one of its salts. The state of the surface should play a certain role in the process of exchange, but an insufficient number of experiments have been conducted as yet to show whether the ultra-sensitive radioactive method may serve to define the microgeometric or physico chemical properties of the surface. *Quintin, Sue and Bizouard* have studied the exchange between a rolled sheet (prepared from an ingot of copper rendered radioactive by irradiation in a beam of deutons) and a solution of copper sulfate at various concentrations. By translating the activity passed into the solution at equilibrium to the number of atomic layers which would be interchanged by means of the process, the authors found appreciable differences according to whether the rolled sheet had been polished electrolytically, pickled in nitric acid, or simply washed in alcohol and ether.

Magnetic Properties and Surface Electrical Conductivity

It was the American physicist *W. C. Elmore* who first recognized the importance of the state of the surface upon the magnetic properties of alloys of iron-silicon and cobalt.[53] The magnetic texture was studied, by microscopic examination at high magnification of the figures formed on the surface by a fine suspension of a magnetic colloid. This method, devised by *Bitter*, necessitates a previous polishing of the material. *Elmore* established that the appearance of these figures is very different according to whether the surface had been polished electrolytically or mechanically; and he concluded that the complex structure of the figures of the mechanically polished



A B

Figure 42. Surface of aluminum sheet after corrosion tests in salt spray (30 gm/l. NaCl) for 120 hrs. Magnifications 270x.
a) Mechanically polished sheet.
b) Electropolished sheet (perchloric-acetic bath).

state corresponded to the surface zones disturbed by the polishing. This conclusion has recently been confirmed by *Williams and Bozorth* who were able, thanks to anodic polishing on an iron silicon alloy, to make a very complete experimental and theoretical study of the "magnetic property."[54]

Important results have been obtained in the *Laboratoire National de Radioelectricité* and in the physics laboratory of the Sorbonne by *P. Abadie and I. Epelboim* with respect to the heterogeneous texture of cold-rolled ferro-magnetic materials.[55] Solution of a superficial layer by electrolytic polishing (in acetic-perchloric bath) of the Permalloy alloy containing 76% nickel anealed in hydrogen, has allowed a considerable increase in the magnetic permeability, while at the same time reducing the loss by "Foucault currents." Thus, in one sample, the permeability measured at acoustic frequencies goes from 3,700 initially to 4,300 and 5,700 after two anodic polishes.

The results are important to the knowledge of the real magnetic nature of the metals, and they allow us to interpret the anomalies of behavior of ferromagnetics to Hertzian waves. From the practical point of view it falls into the new procedures of utilization of metals in radio electricity.[56] It is known that the currents at microwave frequencies are propagated at the surface of the metal, which is called the "skin effect." The state of the surface of the metal should exert some influence, the microgeometry, the physical structure and films of oxides or other chemical impurities intervening to modify the value of the superficial conductivity. This field up to the present has been little explored in spite of its practical interest, because the complicated form of the extremely short wave generators are poorly adapted to the realization of varied states of surfaces.[57] A well adapted apparatus would be necessary for the comparative study of electrolytic and mechanical polishing.

Electron Emission by Metals

Anodic polishing has been shown very useful for certain research and technical applications in the electronic field.

According to *Brown*,[58] in order to determine the work of thermionic extraction on the faces of a monocrystal, it is necessary to use very plane surfaces, parallel to the family of the crystallographic planes and corresponding to an undisturbed network. The conditions are satisfactorily met by electrolytically polishing the specimens designed for the experiments, as has been proven in the case of tungsten.

The studies undertaken in France by *Nineuil* have shown the applicability of this new electrolytic finishing method to suppress the phenomenon called "cold emission" which is quite troublesome in vacuum tube technique.[59]

All metals placed in a chamber at a pressure in the order of 10^{-5} mm. Hg and subjected to a high and negative potential gradient, emit electrons at atmospheric temperatures: this is cold emission, a phenomenon less known than the emission of electrons from a hot metal. This unwanted occurrence imposes a limit on the possibilities of development of high voltage vacuum apparatus (X-ray tubes, Kenotrons, generators used for the study of matter, etc.). In effect, the cold emission of electrons due to the action of the electric field on the negative electrode appreciably disturbs the normal current produced by the heated filament; the electrons emitted by force do not belong to the principal cathode ray and create sudden variations in the delivery of the tube. These erratic and instantaneous variations overshadow the rough modifications of potential which cause a risk of provoking a leakage of the glass wall.

The potential gradient of an electrode is regulated by the radius of curvature of that piece, but this would be quickly limited in practice for it would lead to voluminous pieces difficult to de-gas.

The numerous authors who have studied the phenomenon of cold emission of electrons are in accord on the considerable influence of the state of the surface of the metal, in which the presence of superficial impurities is above all in importance. Knowing that, according to *Langmuir*, electrons are ejected from a metal by a very high electrical field (106 V/cm) which reigns on the ridges, it is logical to think that complete suppression of these would have a favorable effect. Now mechanical polishing introduces impurities, as it is easy to prove by heating a piece of metal polished by the standard mechanical process under vacuum: the brilliant surface becomes dull. Nineuil devised a method, which was quite sensitive, to show the surface impurities: the metallic piece bombarded with a beam of electrons is the site of an intense cathode luminescence. On the contrary, the same metal polished electrolytically retains its brilliance when heated under vacuum and does not show any luminescence when it is subjected to bombardment by an electron beam. Nineuil has thus arrived at the conclusion that electrolytic polishing is the better preparation for surfaces destined to function as cathodes in vacuum tubes. Thanks to the elimination of the micro ridges and superficial impurities, these surfaces no longer exhibit the troublesome phenomenon known as cold emission, on the evident condition that the metal itself be of sufficient purity, for the impurities may diffuse from deep regions and come to contaminate the surface.

These results are of great interest, not only for the scientific study of electronic phenomena, but also for the practical realization of apparatus which use these phenomena. Electrolytic polishing is now in effect in France on numerous pieces which enter into the construction of X-ray tubes, Kenotrons, and electron microscopes.[60]

(References will be found at the end of the series.)

(To be continued)

High Speed Buffing of Screw Heads

DEMANDS for smooth finishes on heads of plated screws, emanating principally from the automotive industry, have made it necessary to buff the heads, either before plating or just after the base copper flash, in order to remove tool marks and irregularities which would show through even the best nickel or nickel and chromium plate. At the same time, users are unwilling to pay the normal costs involved in such buffing operations which have been tedious and time-consuming. Likewise, screw manufacturers sending the product to outside plating shops cannot absorb buffing costs.

The impasse called for development of some means of high-speed automatic buffing, a problem which *W. B. Knight*, president, *Knight Plating Co., Detroit*, has been attacking for the past 10 years or more. Working more or less on his own, he built several versions of automatic buffing machines, finally arriving at a unit which seems to have significant possibilities for a wide range of products other than screw heads for which it was designed.

Hopper Feeds Screws

Equipment includes an inclined hopper into which the unbuffed screws are loaded, a means for picking up the screws one at a time and lining them up in vertical file, an inclined slot down which the file of screws travels to the buffing heads, two parallel V-belts traveling in steel guides under the buffing wheels and spaced so that sufficient pressure is developed to hold the screws securely in vertical position as they pass under the wheels and a discharge chute down which the buffed screws slide as the V-belts spread sufficiently to release them.

Fig. 1 shows the hopper with a load of screws in place. It is of steel construction, 15 inches deep and 23½ inches in diameter at the bottom. A circular plate is provided in the bottom, of such a size that an annular slot is left about 2 inches away from the bottom corner.

As the hopper is rotated through a 1 hp motor and belt drive at about 25 rpm in a clockwise direction the screws fall into the slot, heads up. At a point about "one o'clock" a pair of steel fingers, straddling the slot in the hopper bottom and riding thereon pick up the screws and they descend by gravity between two steel bars, shown descending to the right in Fig. 1, so spaced as to hold the screws loosely. Travel is speeded by attaching small air vibrators at the top and bottom of the slide.

(*Reprinted by permission from Steel, July 18, 1949*)

Construction of Machine

Buffing machine proper, built up of welded steel angles and flats as shown in Fig. 3, carries two horizontal 3/116th-inch shafts at either end, carrying pulleys or sheaves for the chain drive and V-belts. The two end shafts are about 6 feet apart and are powered at the discharge end through a 2 hp motor, speed reducer, chain and sprockets. The pulleys carrying the V-belts are spaced sufficiently apart to permit free passage of the file of screws. As they near the guides they pass over horizontal rollers which pull the belts together just as the screws meet them with the result that the line of screws coming down the charging slide is literally pinched off the slide and carried on under the buffing wheels. The guides or shoes are covered on top with steel plates bolted in position and falling away from the center at an angle of 20 degrees on each side, permitting the buffing wheels to clear them and contact only the passing row of screws.

Five vertical support arms, mounted rigidly in the frame of the machine, and adjustable through turnbuckle-type screws, carry the five buffing wheels.

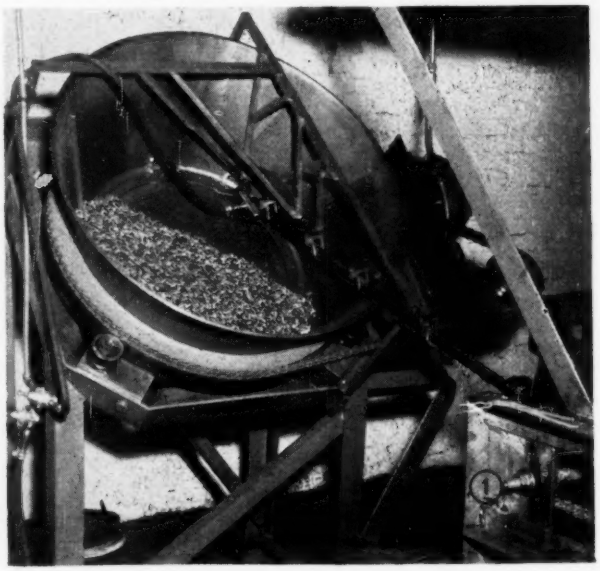


Fig. 1. Hopper and pickup arm of machine for high speed buffing of screw heads. Note slot in base of hopper into which screws fall, to be picked up by curved fork which straddles the slot. Air vibrator is attached to arm to facilitate travel of screws down the slide.

Atop the frame are five 5 hp motors for driving the buffs through V-belts and intermediate shafts with two sets of pulleys which are of suitable relative diameter to provide the proper speed to the buffing wheel. The buffing wheels, built up of standard buffing disks, are adjustable to any angle horizontally. Pressure may be varied by rotating the central turnbuckle screws in one direction or the other; this permits almost any desired degree of "cutting" on the screw heads.

Wheel shafts may be positioned at any angle for the proper buffing action, and be moved in or out horizontally through lateral support screws. Compound is applied to the buff by hand with conventional sticks, although it may be possible readily to devise

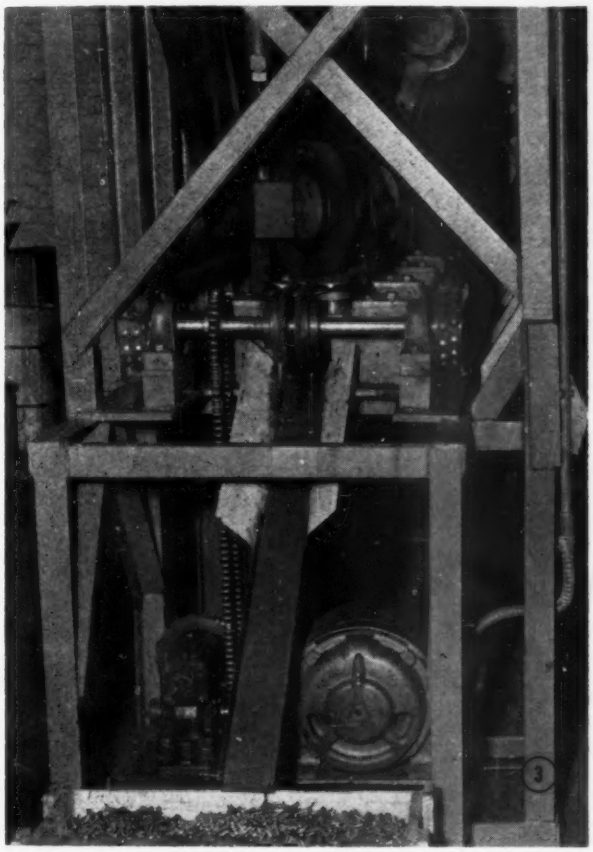


Fig. 2. Discharge end, showing how V-belts spread after they pass horizontal rollers, permitting screws to drop down chute into case. Below is 2 hp motor and reducer for driving the belts.

a means of piping liquid compound to them automatically. In some cases, it has been found that better results are obtained by using no compound at all on the fifth or final buff.

High Production

Production speeds of the unit are spectacular. For example, 7/8 x 8 sheet metal screws with No. 6 heads have been handled at a rate of 73,000 per hour, with a belt travel of 25 fpm. Larger sizes naturally require a longer time, but it is figured that if 15 seconds time under the five buffing heads is required, production can be held at a minimum of 30,000 per hour. As Mr.

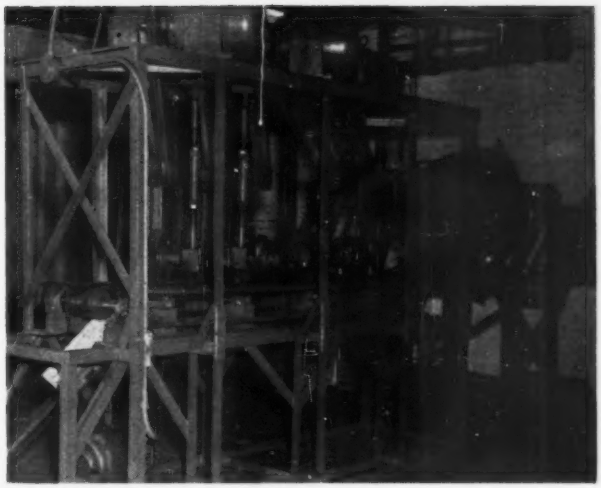


Fig. 3. Overall view of machine, showing the five independently driven buffing wheels, positioned at different angles to cover the entire surface of each head.

Knight tells it, the machine will do in an hour what rack buffing (placing screws in drilled holes in wood racks and holding them against buffing wheels) would require seven men working a full day. Average sizes of sheet metal screws range from 25,000 to 55,000 pieces per case, so it would appear practical to buff a case an hour.

Discharge end of the machine is shown in Fig. 2, in which it will be observed there are two leather-link belts at either end of the driveshaft. Function of these belts is to relieve the load on the central V-belts which carry the screws and to divide the power evenly between the two sides.

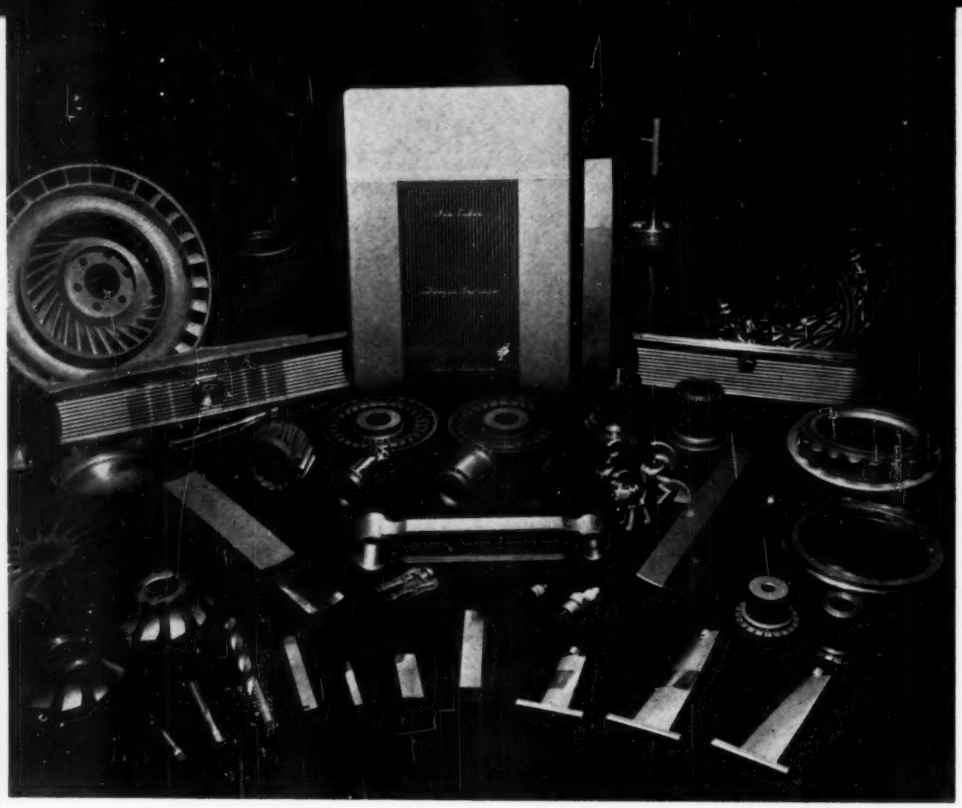
Much of the success of the machine hinges upon the successful design of the hopper and pickup arrangement. Proper angle of the hopper, width of the slot into which the screws fall (0.190-inch for No. 6 to 10 screws inclusive), angle and curvature of the pickup fingers are three factors which only extensive trial and retrial finally proved out.

Versatility

By changing the size of the disk in the bottom of the hopper, a wider or narrower slot can be obtained. Thus, a slightly larger disk narrows the slot to accommodate No. 2 to 5 screws, while a slightly smaller disk would open up the slot to admit No. 12 to perhaps 3/8-inch; a still smaller diameter would take 5/16 on up to 1/2-inch sizes.

It is planned to install exhaust hoods and ducts over each buffing wheel to carry away buffing compound thrown off the wheels which travel at speeds on the order of 3000 rpm.

Since the human factor is eliminated in the buffing operation, the uniformity of the machine-buffed screw heads is nearly perfect. This, plus the high speeds possible and the relatively simple design of the machine, suggest the unit may have interesting possibilities for future application of the rapid and automatic buffing of small uniform pieces or parts.



Typical of the many types of parts that have been processed by liquid abrasive blasting.

Blast Cleaning With Suspended-Abrasive Media

By Edward Rosen, *New York, N. Y.*

IN LIGHT of its versatility and adaptability in the fabrication of an ever widening range of industrial products, blast cleaning with suspended-abrasive media is receiving warranted and growing attention as a modern method of mechanical finishing. In effect, the method is a controlled, speeded-up version of the ageless surf pounding its sand-laden spray against rocks and beaches, for the process consists of the use of a circulating abrasive suspended in an aqueous solution. This spray, under pressure, is directed by means of a nozzle against the metal. By controlling such mechanical variables as abrasive mesh size, type of abrasive, ratio of abrasive to solution, air pressure, angle of impingement, and gun distance, it has become possible to produce a wide range of distinct satin and matte finishes. In addition to this variety of decorative effects, this method of blasting offers many other distinct advantages and is being employed in myriad applications ranging from the treatment of dies and tools to the final finishing of the end product of the dies and tools.

One of the original processes involved the use of ordinary dry sand from a standard-type sand blast generator which fed the sand to a special gun and nozzle where a metered flow of water was mixed with the sand under air pressure. Thus, the dust hazard of dry sandblasting was eliminated, and the wet sandblasting method was readily adopted by structural steel manufacturers and foundries for scale removal and cleaning of rough castings. Continual refinements of the process led to the development of numerous corrosion inhibitors which, when added to the solution, retarded oxidation on the metal surfaces being blasted.

Intensive experimental work has been carried on with various abrasives. Cereals, rice husks and ground peach stones were among the hundreds of abrasives bombarded against the metals in the laboratories. Novicite, a silicious rock found in a natural decomposed state in Arkansas, and available in mesh sizes of 100 to 5,000 works very nicely for this type of blasting. This material, in a wide range of meshes and in a prepared state ready for use, is marketed by several firms.*

In addition to the abrasive development, the availability of versatile cabinet equipment in which to carry out the operation has made the process applicable to a wide variety of jobs. The equipment used for liquid blast cleaning includes a water tight cabinet

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* *Novaculite—Vapor-Blast Mfg. Co.*
Pangbornite—Pangborn Corp.

Figure 1. View of the interior of a liquid blasting cabinet.
(Courtesy Vapor Blast Mfg. Co.)

provided with a hopper tank for mixing, storing and recollecting the suspension, a circulating pump, and a blasting gun equipped with two lengths of flexible hose, one for abrasive feed and one for air supply. The cabinet has vision windows, loading doors, air control valves, and a ventilating system to remove the fog created by the blasting. The operator works from the outside of the cabinet and places his arms through gauntlet-covered armholes. The work to be finished is held in one hand or rested on a work table while the other hand directs the blasting stream.

Of the numerous advantages cited for this method, the following appear most important at this time:

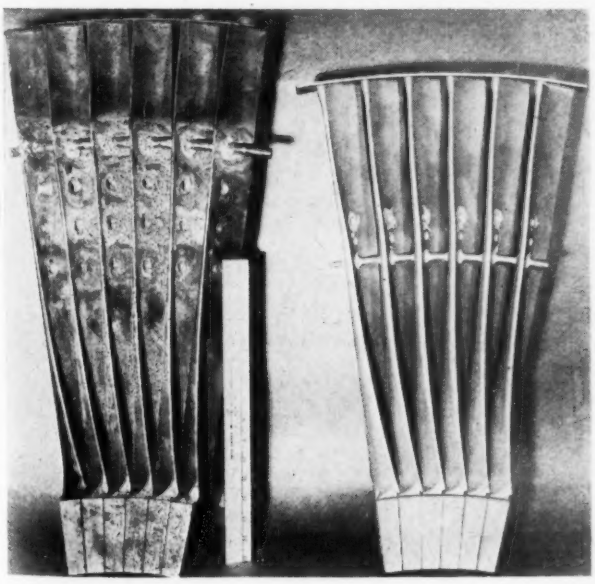

Figure 2. Turbine blades at right were cleaned by liquid blasting after welding operations.
(Courtesy Vapor Blast Mfg. Co.)

1. Produces a very smooth surface with a non-directional finish that appears finely etched.
2. The minute etching effect of the abrasive honing causes the surface to hold and distribute lubricants evenly.
3. The peening action has the effect of cold working the surface of the metal.
4. It will hone surfaces when tolerances are as low as .0001 inch, and will reach crevices in intricate parts which are hard to deburr and polish by other methods, maintaining contour control.
5. Economical and rapid.
6. Simplicity of control and operation.

Suspended abrasive blasting already has been used in production lines for deburring; surface finishing; removing heat treat scale, grinding compounds and other contaminants; removing grinding lines and fine machine marks; preparation for electroplating, electropolishing and other surface treatments; cleaning up fillets and eliminating "metal fuzz" from machined and cloth polished surfaces; cleaning of aluminum and magnesium castings after removal from sand molds, and for improving surfaces and increasing productive life of molding dies for rubber, plastic, glass and other materials.

Because the spray effect permits uniform removal

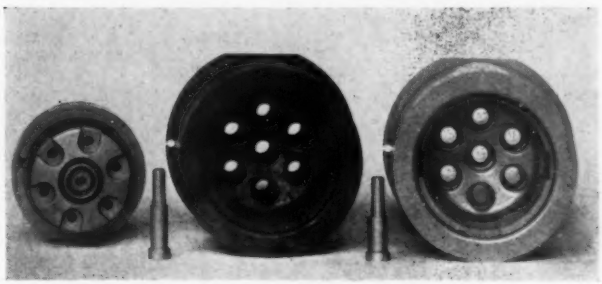

Figure 3. Dies for molding plastic distributor caps. Untreated die in center.
(Courtesy Vapor Blast Mfg. Co.)

of material from contoured surfaces and is effective in deburring internal fillets, edges, and corners that are virtually impossible to clean, deburr or finish by other means, this process has been widely used by the aircraft industry for engine overhaul, propeller maintenance, paint removal and new parts manufacture. Supercharger impeller blades, gear teeth, splines, connecting rods, guide vanes, threaded parts and various instrument details necessitating close tolerance finishing or cleaning have been successfully treated on a production basis. Liquid blasting of aircraft engine cylinders which have been porous-chrome plated has shown reduction in scuff and wear polish because the treatment opens up secondary lubrication channels, thereby increasing surface area for lubricants. In addition to effectively removing electrolytic debris from bearing surfaces, it also eradicates any grinding or polishing lines which otherwise might serve as natural drainage routes for the lubricant. The matte finish itself provides a good lubrication surface, since it is nothing more than a mass of microscopic craters which will retain oil beads capable of sustaining a great compression load. In cylinders thus treated, there has been reported by engine manufacturers results indi-

cating less oil consumption, less wear polish of the cylinder walls, and faster breaking-in time.

Deburring of fluid coupling impellers in one plant is accomplished in eight minutes by this method, as contrasted to forty minutes consumed by conventional hand treatment.

In the jet propulsion field, this new process has served as an economical substitute for hand polishing of blades after heat treatment. The blades are machined, ground to size and heat treated, then liquid blasted to clean and finish, eliminating all hand polishing. Economy is also effected in the treatment of steam turbines. See Figure 2.

Another important use for suspended-abrasive blasting which has made it widely adopted in the aircraft and automotive field is in providing a finish for such cutting tools as reamers, drills, taps and hobs. In addition to removing microscopic "feather" edges from a tool after grinding, it produces a surface which permits better chip flow as well as increased lubrication

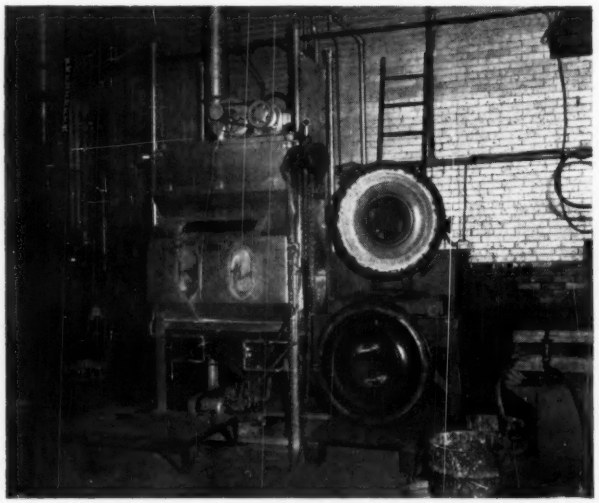

Figure 4. Liquid blasting set-up for cleaning a tire mold. Note sliding carrier for moving parts into the cabinet.
(Courtesy of Pangborn Corp.)

retention. The blending of grinding lines into a non-directional finish also reduce stress concentration and therefore provides increased safety against cutting edge chipping or cracking.

The effects on a conventional hob tooth were markedly beneficial, imparting a production run of 1850 gears per grind, as contrasted to the normal 1200 per grind when not followed by liquid abrasive blasting. (See Figure 6.)

In preparing new molds and dies, or in the cleaning or maintenance of them, this method has produced unusual results indicating it is a dramatic time saving process as well as one which provides longer service life. Removal of heat treat scale leaves a satin matte finish which in many cases is suitable for immediate further production or which, when necessary, can easily be brought to a mirror finish. In the latter case many of the time-consuming polishing steps usually needed for a mirror finish are eliminated by having started the polishing sequence with a very fine satin finish. The resultant satin surface has high lubrication retention value and there is a greatly improved die life.

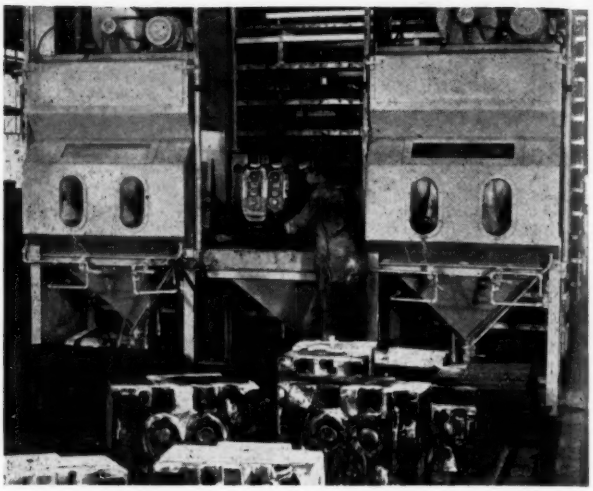

Figure 5. A dual set-up for liquid blast cleaning which permits the economical use of different sized abrasives.
(Courtesy of Pangborn Corp.)

Because the abrasive easily reaches the fine crevices, there is a minimum of dis-assembly of intricate dies in the cleaning process. Liquid blasting of drawing, forming and extrusion dies has been effective in assuring longer production runs because the dies' non-directional finish and absence of grind lines facilitate metal flow. Rubber and plastic molders have reported increases of production life between cleanings as well as longer over-all life. (See Figue 3.) In the glass industry, cleaning molds to remove tenacious carbon

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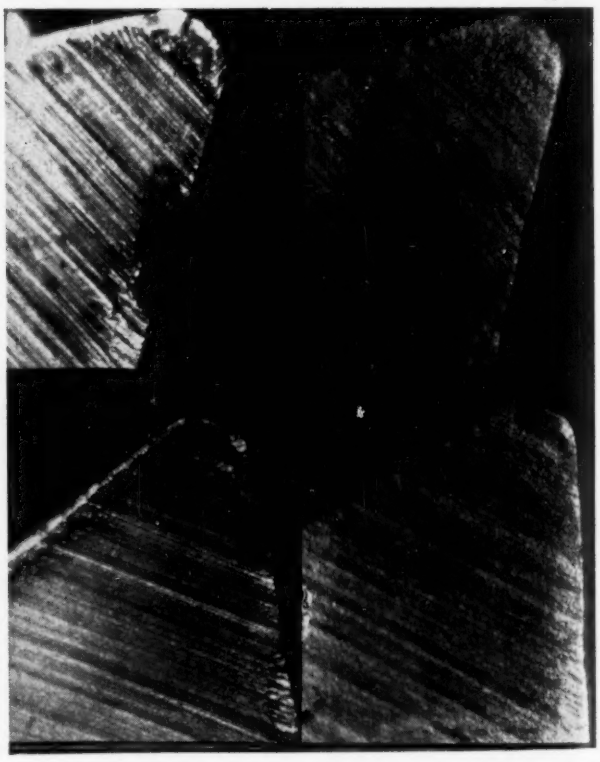


Figure 6. Illustrating the application of liquid blasting to the maintenance of cutting tools.
Upper left—Conventional hob tooth, revealing metal build-up after use.
Upper right—Same tooth after liquid abrasive blasting.
Lower left—After cutting 1850 gears.
Lower right—Liquid blast cleaned for re-use.
(Courtesy of Pangborn Corp.)

Gaseous Plating

Dry Method Achieves High Rates of Deposition and Permits the Processing of Many Materials Not Readily Treated by Conventional Plating Methods

IN THE course of investigations directed toward the economical formation of molds from finished articles, a method of gaseous metal deposition was evolved which in commercial stature far overshadows the subject matter of the original study.

Exhaustive mold research uncovered basic theory which had lain dormant in the technical literature for more than half a century. In England in 1890, *Ludwig Mond*, while engaged in studies of the catalytic effect of finely divided nickel on carbon dioxide gas, derived a black, amorphous powder mixture of carbon and nickel.

To prevent oxidation of the nickel, Mond cooled the black substance in a stream of carbon monoxide, burning the poisonous mixture in a Bunsen burner.

Intrigued when the flame unexpectedly became luminous, this keen observer heated the tube through which the gases passed to determine the cause of the luminosity. To his surprise, the tube became coated with a deposit of nickel.

Mond, the first to discover a volatile nickel compound, noted his observations and then went on to develop the Mond process—still used today—for obtaining pure nickel through the use of carbon monoxide gas.

Commonwealth* engineers took Mond's fifty-year-old discovery of volatile nickel carbonyl as the starting point for a new project aimed at adapting this little-used compound to actual plating on a production basis.

Chemical investigations supplemented by mechanical and electro-chemical studies led to the construction of a model apparatus for actual operation and testing.

Principal behind the small scale plating unit is simple; a metal carbonyl gas is circulated about the object to be plated. The workpiece is heated and the metal plates out as the gas contacts the hot surface.

The model unit consists of a carbonyl generator supplying a plating chamber in a closed system in which carbon dioxide acts as a carrier gas and provides an inert atmosphere for the operation.

Infrared units supply heating to the plating chamber. Induction heating was also tested, but found to produce a different effect. Valving in the gas circulating system is arranged for recycling the gases for most efficient operation.

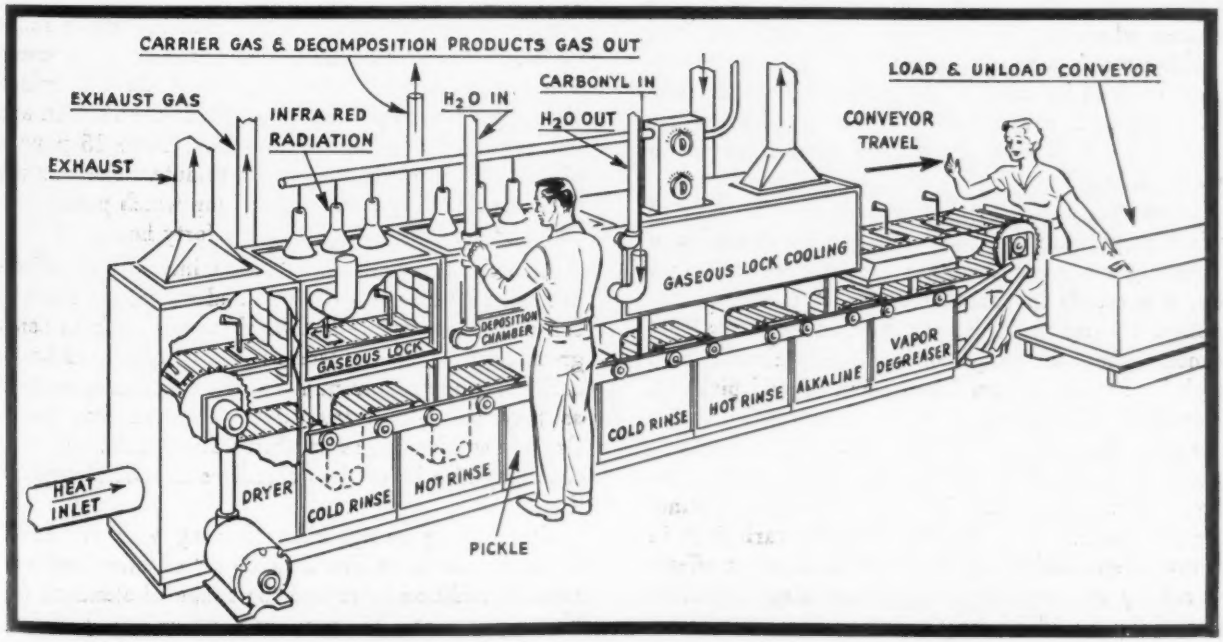
Preliminary test runs proved the value of the process, though difficulty was first encountered in achieving good adhesion between plate and base metal. However, desorption treatment of the latter eliminated this problem. With other minor adjustments it became apparent that the dry method of carbonyl plating made possible a much higher rate of deposition than had ever been thought possible. One test run on nickel deposited a total of 13 pounds, 6 ounces of metal in a single pass plating cycle lasting 60 minutes.

Other tests brought out additional confirmation of the valuable possibilities of the dry method. Complicated shapes, irregular surfaces and internal areas offer no problems. Coverage is uniform in the thermal decomposition process without special arrangements.

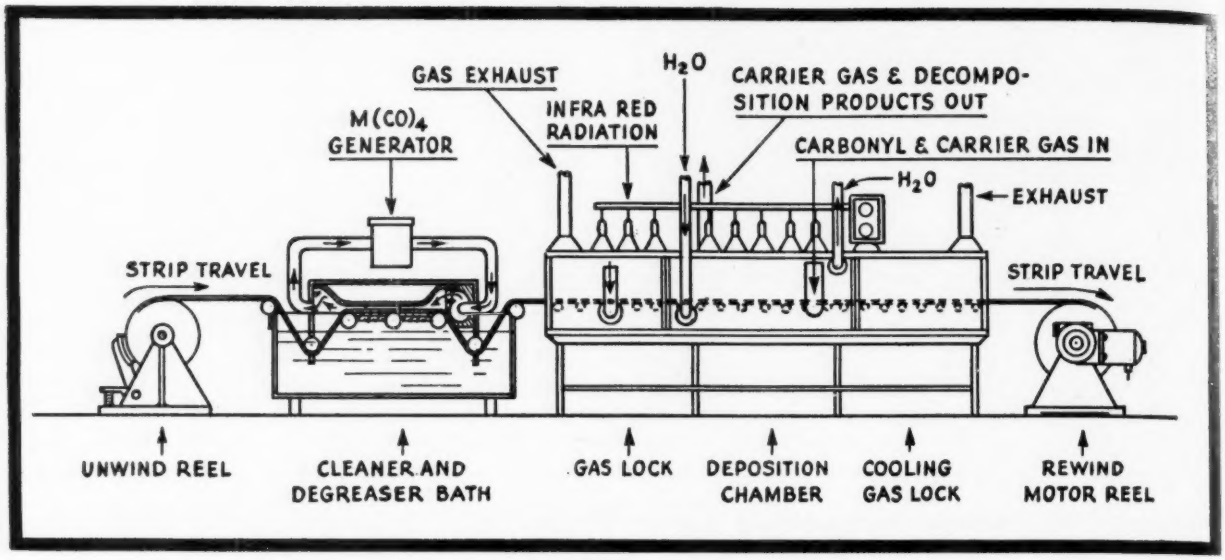
Carbonyls of a number of other metals in addition to nickel may be used. Iron, chromium, tungsten and molybdenum are among them.

Because the process is dry, many materials which cannot be handled by conventional electrochemical

* *Commonwealth Engineering Co., 1771 Springfield St., Dayton, Ohio.*



Sketch of a gas plating arrangement for the plating of commercial articles.



Schematic drawing of a gas plating installation for continuous coating of strip metals.

methods may be used. As heat is the sole means of deposition, any material which can withstand the 400° F. heat required may readily be plated. Ceramics, tiles, glass, wood, and other materials may be used. Alloys may be secured.

High speed deposition means that moving strip may be continuously plated on a production basis. It may even be possible to apply a metallic layer to a fine, hard paper web moving at a substantial speed through the chamber.

A further idea of the speed of the process may be gained from the test results obtained in plating continuous strip; an amount of metal which by conventional methods would have required 30 minutes to apply, was deposited in *four seconds.*

Laminates of plated metals can also be achieved—merely by halting the deposition process of the desired point and depositing a second film of the same or of a similar metal over the first.

Overall, the carbonyl process is a straightforward operation which sidesteps many of the complicated problems of conventional wet electroplating. Delicate balance of complex solutions is eliminated, as are intricate electrode ararngements for difficult work.

Additional study in the Commonwealth gas plating method is going forward—directed to the development of high speed production units for commercial application of the process.

BLAST CLEANING

(*Concluded from page* 78)

by hand is a long and costly method. Suspended-abrasive blasting has been successfully employed as an economical substitute for hand cleaning. Even when bright polishing of the mold follows liquid blasting as in cases where crystal clear glass is demanded, final polishing requires no more than 25% of the time normally required for hand cleaning alone. The efficiency of this method, coupled with minimum of metal removal and dimensional change, are advantages not to be overlooked.

The process is also making inroads into the field of surface preparation for electroplating. When used as a pre-plating treatment for high carbon steel and cast iron, it succeeds in completely removing surface impurities. Spring steels, for instance, can be effectively cleaned without the danger of hydrogen embrittlement, which is often encountered as a result of acid pickling.

Liquid blasting produces a satin matte finish which is gaining favor as a final decorative finish for such objects as automobile grilles, instrument panels, refrigerator trimmings and jewelry. Numerous distinct satin finishes can be produced by slight variations in the operation conditions, and certain two-tone effects are readily achieved by a simple masking operation followed by liquid blasting, prior to chrome plating. The satin surface thus produced has a non-glare characteristic making it popular as a final finish for verniers, instrument dials, and optical parts.

The cabinets designed for use with the liquid-abrasive blasting process are very flexible. A cabinet may be worked up into an automatic conveyor type using turntables, tumbling barrels, fixtures and belts. (See Figures 4 and 5.) A single unit can produce a range of finishes by simple changes in abrasive, air pressure and gun distances. Normally, the abrasive is mixed with approximately 50% by weight of the solution and is discharged at a high tip velocity, 10 to 15 pounds of material being delivered per minute. The mixture is re-circulated by means of a pump which permits reusage of the abrasive up to about forty hours.

Although this article has dealt mainly with the effects produced by the use of Novicite abrasive, the cabinets can utilize any of the known abrasives, such as sand, ground quartz, etc., as well as the manufactured boron carbide, garnet, aluminum oxide or alumina, as long as they fall within the 100-5,000 mesh size range. Organic solids such as crushed walnut shells and corn cobs may also be used as abrasives in special applications.

Generally speaking, blast cleaning with suspended abrasives has been found to be an effective and economical addition to extend the range of standard dry blast equipment. Its operational versatility should result in even greater applicability in the future.

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating on Lead Castings

Question: Can you give us a satisfactory cleaning and plating cycle for small lead castings? Naturally we want a cycle that calls for as little buffing work as possible, as our product, which is finally gold flashed, is a very competitive item as far as price goes.

W. A. J.

Answer: A typical cycle for this type of product would be about as follows:

1) Solvent degrease.
2) Electroclean in a mild cleaner, cathodically, for as short a period as possible.
3) Acid dip in a 5-10% fluoboric acid bath. Rinse thoroughly.
4) Copper strike in a cyanide bath until just covered.
5) Rinse well and dip in 2% sulfuric acid. Rinse.
6) Bright nickel plate for about 5-10 minutes. Rinse.
7) Flash in gold until covered. Rinse in hot water.
8) Dry thoroughly and lacquer if required.

Poor Throwing Power in Chrome Bath

Question: Recently we started up our small chrome plating bath again after it had been shut down for about a month. When the bath was shut down, we carefully covered it over so no dirt would get into it, and in starting it again any water lost by evaporation was replaced. This bath gave very good results the last time we used it, but now we can't seem to get any coverage in the recesses of our parts. Everything seems to be the same, temperature, current, chromic acid-sulfuric acid ratio, and we are at a loss to explain our trouble. Maybe you can suggest a way out.

F. T.

Answer: We would suggest that you take a look at the anodes. These should have been removed from the bath during the shutdown, and may be covered with a heavy film of lead chromate, which cuts down the throwing power due to a build up of trivalent chrome. This film of lead chromate must be removed by scrubbing, and care should be taken to see that a sufficient total anode area is maintained at all times.

Heavy Silver Plating in a Single Immersion

Question: We are producing what is known to the trade as "quadruple plate" on our silverware. Our method is to use 3-4 operations in putting on this heavy plate, but we understand that several firms are doing this in a single operation. Can you tell us how this may be done?

B. A. W.

Answer: Older methods for producing heavy silver deposits usually involved removing the articles from the plating bath at several intervals during the total cycle for purposes of wet scouring or scratch brushing. The wheel operations had as their purpose the smoothening of the deposit, so that subsequent deposits would not exaggerate any roughness and make the final buffing operation too lengthy. In modern plating baths, where foreign, insoluble particles can be controlled through the use of high-purity anodes and constant filtration, it is possible to produce heavy deposits equivalent to the "quadruple plate" without this intermediate scratch brushing. Another development that is being used today is periodic reverse current plating, which also makes possible the development of heavy, smooth deposits. Still another method that could be used would be to make your silver plating bath function both as a plating bath and an electropolishing bath. In this way you could plate for a certain length of time, reverse the polarity for a short period to polish the deposit, then repeat these operations until the desired thickness of deposit was built up. Here again the finished deposit would be very smooth and lustrous.

Blackening Stainless Steel

Question: We are interested in putting a dull black finish on some stainless steel parts for optical instruments. Can you tell us if this can be done in an economical manner and give us the necessary details?

T. R. D.

Answer: Several methods are available for blackening stainless steel. One uses a fused salt bath containing dichromate, and operates at a temp. of 750°F. Another involves immersion in an aqueous bath similar to blackening baths for other metals. Both methods are proprietary, and the names of suppliers are being sent to you.

Blistering of Brass-Plated Die-Castings

Question: We are forwarding several samples of blistered and spotted-out die-castings that have been brass plated. After examining these we would appreciate any suggestions that you might make to overcome this problem.

A. S. R.

Answer: Both the spotting-out and blistering on your parts come from the same cause; pitting and surface cavities on the die-castings. This was de-

termined by cutting and lifting off the blister, and in every case a surface defect was uncovered. This is a common type of defect in die-castings, and we would suggest that you first consult with your die-caster to see if this casting defect cannot be eliminated, or at least alleviated, by some changes in his process. With castings having a smooth, dense surface, only a minimum of polishing or buffing will be necessary, which lessens the tendency to polish off this dense surface "skin" and open up any sub-surface cavities.

About the only remedy for this type of defect is to try to smear metal over these fine openings, either by heavily buffing the base metal itself, or better by first plating on the parts about .001" of copper, then flowing this soft copper over the fine openings. A complete drying out of any entrapped solution before the flowing operation would probably help. At best, this smearing of metal over the surface is a poor substitute for a sound, dense surface in the castings.

Using Crystallized Sodium Carbonate in Cleaners

Question: Recently we were offered several barrels of ordinary washing soda at an attractive price, and we are wondering if this material is satisfactory for use in our alkaline cleaners, which we make up to our own formula?

C. S.

Answer: Crystallized sodium carbonate, or washing soda, is satisfactory for use in metal cleaners. The only requirement when using this material is to increase the total amount used in the formula to give you an equivalent amount of sodium carbonate, as the crystallized salt contains ten molecules of water. To get the equivalent amount of the crystallized salt to use in any formula, divide the amount of soda ash required by the figure 0.37.

Plating for Lubricating Purposes

Question: We understand that copper plating is used on sheet metal that will subsequently be drawn into cup shaped articles, and that it functions in this case as a lubricant. What thickness of coating is usually used for this purpose?

N. J. K.

Answer: Copper, lead, tin and cadmium plating have been used with success as drawing lubricants. Usually the deposits are about .0002-.0004" thick, but this varies over a wide range, depending on the severity of the drawing operations. Thinner deposits are also used in wire drawing operations, and here the deposit is usually about .00005" thick. Obviously the thickness should be kept to a minimum, both for cost reasons and for purposes of subsequent removal of the coating when necessary.

Making Etched Brass Nameplates

Question: We would like some formulas for solutions that can be used for etching brass for making nameplates and similar items.

S. W. F.

Answer: After the application of the resist to those areas that are wanted raised, the following procedure is followed. The mixture most commonly employed is a 30-38° Baume solution of ferric chloride at room temperature. The bath should be agitated slightly to promote uniform etching. This solution gives a smooth etch with a speed of approx. .005" per minute with a minimum of undercutting. No toxic fumes are liberated, which is an advantage over strong nitric acid baths. This bath is useful for nearly all the commercial brasses from 70-30 up to 95-5, and including phosphor bronze and nickel silver, but is not useful for the leaded alloys. On leaded alloys it leaves streaks of exposed lead, and for these alloys a better solution is a weaker one of about 30° Baume strength. With all leaded alloys the operations are more critical.

This ferric chloride bath is fairly fool-proof in operation, about the only type of trouble encountered being pitting. This usually indicates a spent solution which should be discarded. After considerable use the bath will turn a dark brown color and should also be discarded, as the cost of regenerating the bath would be in excess of the cost of making up a new one.

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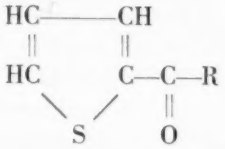
PATENTS

Bright Copper Plating

U. S. Patent 2,471,918. *K. S. Willson and D. G. Ellis, assignors to Harshaw Chemical Co.*

In a process for electrodepositing bright copper, the step which comprises electrolyzing an aqueous alkaline copper cyanide solution and a minor proportion of a soluble acyl thiophene compound corresponding to the formula

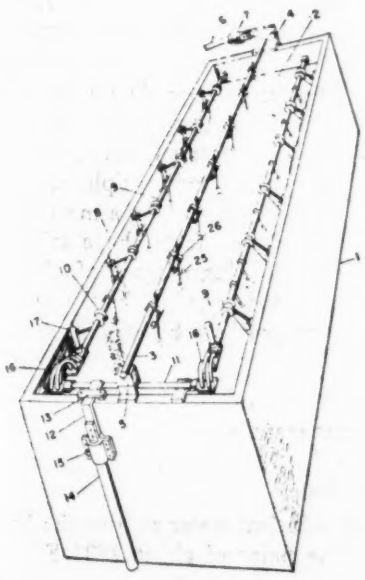


where R represents a radical of the class consisting of alkyl and aryl radicals having not more than six carbon atoms, the copper cyanide concentration being from 30 to 150 grams per liter and the concentration of the acyl thiophene compound being from 0.10 to 3.75 grams per liter.

Adjustable Anode Rod Arrangement

U. S. Patent 2,472,796. *W. G. Evans & W. C. Schafer, assignors to the Glenn L. Martin Co.*

An anode-rack suspension for an elongated electro-plating tank having a work-supporting rod extending along the middle of the tank, comprising a plurality of parallel brackets of equal length spaced longitudinally along one side wall of the tank and each having one end pivoted on a vertical axis to said side wall, a conductive anode-rack-supporting rod extending longitudinally of said tank, and means including an insulator arranged between said anode-rack-supporting rod and the other end of each bracket for pivotally supporting said anode-rack-supporting rod for movement relative thereto about a vertical axis, whereby said anode-rack-supporting rod may be moved relative to the side wall of the tank, toward and away from the work-supporting rod to regulate the plating of the work supported thereby.



Conversion Coating for Aluminum Alloys

U. S. Patent 2,472,864. *F. P. Spruance & J. H. Thirsk, assignors to American Chemical Paint Co.*

In a process for coating surfaces of aluminum and alloys thereof in which aluminum is the principal ingredient, the step which consists in subjecting the surface to the action of an acid aqueous solution the essential active coating-producing ingredients of which are fluoride ion, dichromate ion, phosphate ion, arsenate ion and hydrogen ion, the ions being present in amounts stoichiometrically equivalent to

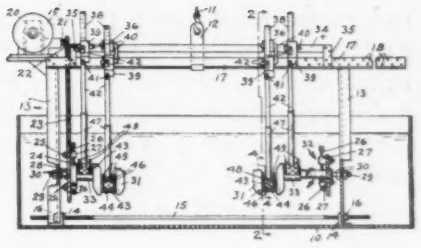
	Grams per liter
Fluorine	0.9 to 12.5
Chromic acid (CrO_3)	3.75 to 60.0
Phosphate plus arsenate (calculated as PO_4)	6.0 to 285.0
Arsenate (As_2O_5)	0.2 to 3.0

the ratio of fluoride ion to dichromate, expressed as $F:CrO_3$, being between 0.135 and 0.405; and the pH of the solution being between about 1.6 and 2.2, as measured by the lowest value indicated by a glass electrode pH meter within the first ten minutes of immersion of the electrode in the solution.

Apparatus for Plating Crankshaft Journals

U. S. Patent 2,473,290. *G. E. Millard.*

Apparatus for electro-plating the main and connecting rod bearing journals of a crankshaft which comprises a tank containing an electro-plating bath in which the crankshaft is submerged; means connecting the crankshaft with a cathode; means for rotating the crankshaft in the electro-plating bath; and an anode means slidingly mounted on and urged toward



the journal surface of the crankshaft being plated, said anode means comprising an arcuate shaped anode, having its center portion in one circular path and its side portions bent radially inwardly therefrom at their ends, pivotally interconnected and angularly disposed link means connected at one end to a fixed support and at the other end to the anode and connecting the anode with a source of anode current, non-conductor means slidingly contacting and rubbing the journal surface being plated and supporting the anode in spaced relation thereon, and shielding means at the ends of the anode, extending inwardly toward the journal being plated, and limiting the path of current flow there past.

Passivating Treatment for Ferrous Metals

U. S. Patent 2,473,456. *E. A. Thurber, assignor to Bell Telephone Labs.*

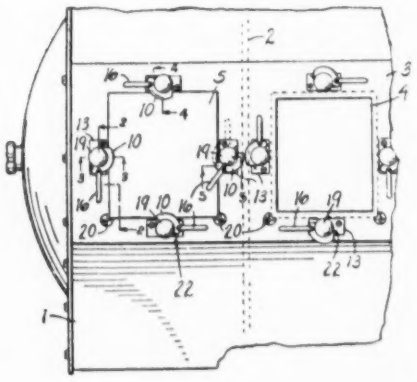
The method of improving the rust resistance of a surface of a ferrous metal object which has a tendency to rust comprising subjecting said object to a preliminary treatment comprising at least two of the operations of heating said object in the presence of oxygen until an oxide coating is formed on the surface, heating said object in an atmosphere of hydrogen at a temperature sufficient to cause occlusion of hydrogen at the surface of said object and to reduce any oxide coating present on the surface, and contacting said object with an aqueous solution of a non-oxidizing acid of sufficient strength and for a sufficient time to roughen the surface of said object by etching and to remove any oxide coating which may be present, said operation of heating in the presence of oxygen being followed by one of the other of said operations, at least one of said heating operations being carried out at a recrystallizing temperature for said metal until recrystallization of the metal at the surface of said object occurs, the surface after said preliminary treatment being free from deep scars, cracks, pits or segregated impurities,

and subsequent to said preliminary treatment immersing said object with agitation, in an aqueous solution of hydrogen peroxide at a temperature in the vicinity of room temperature, said solution of hydrogen peroxide containing at least 5 per cent by weight of hydrogen peroxide, raising the temperature of the hydrogen peroxide solution having said object immersed therein to a temperature in the vicinity of its boiling point, maintaining the solution at that temperature for at least about 5 minutes and allowing said object to cool while in contact with said solution.

Door Arrangement for Tumbling Barrels

U. S. Patent 2,474,461. *R. E. Bogema, assignor to Sturgis Products Co.*

The combination in a container having an enclosure wall provided with a door opening, of a removable door provided with an inwardly facing gasket adapted to seat against the outer side of the enclosure wall at the edges of the door opening, latch studs mounted on the enclosure wall at the edges of the door opening, camming latch members rotatably mounted on said studs to be swung into clamping engagement with the outer side of the door, said latch members being provided with projecting portions at the front ends of their cam portions which overlie the door and are spaced from the door when it is fully closed and when the latch members are in partially open position, stops on said enclosure wall with which said projecting portions engage when the latch members are fully closed, said stops being adapted to coact with the rear ends of the latches when the latches are in fully open position, and springs on said studs at the outer sides of said latch members acting to urge them yieldingly inward, said latch members being rotatable about said studs in their latching and unlatching movements and slidable longitudinally of said studs under the action of said springs.



Conversion Coating for Aluminum

U. S. Patent 2,471,909. *Frank P. Spruance, assignor to American Chemical Paint Co.*

A process for coating aluminum consisting in treating the metal with an acid aqueous solution the essential, active, coating-producing ingredients of which are fluoride ion, dichromate ion, arsenate ion and hydrogen ion, the ions being present in amounts stoichiometrically equivalent to

	Grams per liter
Fluorine	0.9 to 12.5
Chromic acid (CrO_3)	3.75 to 60.0
Arsenate (AsO_4)	3.24 to 462

the ratio of fluoride ion to dichromate, expressed as $F:CrO_3$, being between 0.135 and 0.405; the pH of the solution being between about 1.4 and 2.8, as measured by the lowest value indicated by a glass-electrode pH meter within the first ten minutes of immersion of the electrode in the solution, and heating the treated metal to at least partially dehydrate the coating formed by the solution.

Inhibited Acid for Steel Pickling

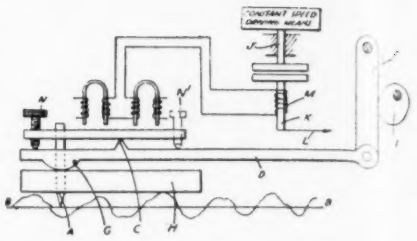
U. S. Patent 2,474,179. *F. N. Alquist & C. W. Hopkins, assignors to Dow Chemical Co.*

A composition for cleaning a ferrous metal surface comprising an aqueous solution containing from 5 to 25 per cent of HCl, from 0.1 to 2 per cent of an organic nitrogen base selected from the group consisting of pyridine and quinoline and from 0.1 to 5 per cent glyoxal.

Roughness Measurement of Surfaces

U. S. Patent 2,474,015. *H. Shaw.*

A device for determining the roughness of a surface having peaks and valleys comprising a support adapted to rest upon the peaks of said surface, means for traversing said support over said peaks of said surface, a stylus for engaging said surface carried by said support and movable relative thereto in a direction normal to the plane of movement of the support, means actu-



ated by movement of the stylus relative to the support independently of the extent of such movement, and means for summating the periods of such actuation.

Etching Aluminum

U. S. Patent 2,472,304. *R. B. Mason, assignor to Aluminum Co. of America.*

The method of etching aluminum surfaces, which includes making the surface an anode in an electrolytic cell, the electrolyte of which is an aqueous solution having as the essential etching component at least 0.5 per cent by weight of a compound selected from the group consisting of barium hydroxide and strontium hydroxide.

The method of preparing a printing plate having an aluminum surface, which comprises coating a portion of said aluminum surface with an etch resisting material, and subjecting the uncoated portion of said surface to the action of an etching medium, consisting of an aqueous solution having as the essential etching component at least 0.5 per cent by weight of a hydroxide selected from the group consisting of barium hydroxide and strontium hydroxide.

Blackening Stainless Steel by Immersion

U. S. Patent 2,476,700. *D. J. Clini, assignor to Heatbath Corp.*

A bath for imparting a black coating to stainless steel made up by adding together in aqueous solution a composition of a permanganate, a hydroxide, a sulphite, and a sulphate, each of said compounds having a metallic constituent chosen from the alkali metal group, said ingredients of the bath being added together in the approximate proportions by weight of

	Parts
Hydroxide	80
Permanganate	2
Sulphide	3
Sulphate	1

and sufficient water to give the bath a boiling point of about 250° F.

Engineering Information Useful In Designating Metallic Surface Treatments

Engineering Data Sheet

DECORATIVE NICKEL AND CHROMIUM PLATING ON COPPER ALLOYS

A Comparison of Plating Thickness Specifications of Various Services, Societies, and Industrial Firms

AMERICAN SOCIETY FOR TESTING MATERIALS

Specification B141-45

Minimum Thickness on significant surfaces—

	Nickel	Chromium
Type F.C.	.0005″	.00001″
Type K.C.	.0003″	.00001″
Type Q.C.	.0001″	.00001″

Notes—

Copper undercoats are permissable, but do not affect the required thickness for either nickel or chromium.
Chrome thickness checked by spot test. Nickel thickness checked by microscopic or magnetic method.
When brass is the base metal, the above Type Numbers become respectively Type F.B., K.B., and Q.B. Same plating thicknesses apply.

NAVY DEPARTMENT

Specification 46-P-4 Type 1

Minimum thickness on significant surfaces—

	Indoor Service	Outdoor Service
Nickel + Copper	.00075″	.002″
Final Nickel	.0004	.001
Chromium	.00002	.00002

Notes—

In outdoor service coatings, if copper is used in thicknesses over .0001″ the minimum thickness shall be .00075″.
Significant surfaces are those touched by a ¾″ diameter ball.
Spot test used to check chrome thickness. Other plating checked by microscopic method.

GENERAL MOTORS CORPORATION

Specification 4251-M

Minimum Thickness on significant surfaces—

	Nickel	Chromium
Code 30	.0003″	.00001″
20	.0002″	.00001″

Notes—

Copper undercoats may be used, but are not required. Final nickel thickness given above prevails in either case.
No Salt Spray specifications on copper-base alloys.

PACKARD MOTOR CAR COMPANY

Specifications 1406 & 1406-A

	Nickel	Chromium
Interior use	.0002″	.00001″
Exterior use	.0003″	.00001″

Notes—

No Salt Spray specifications on copper-base alloys.
A copper flash is optional before nickel, but in no way affects the final required nickel thickness.

SOCIETY OF AUTOMOTIVE ENGINEERS

This organization has no official regular specifications for nickel-chrome plating. It recommends that the specifications set up by the American Society for Testing Materials be used insofar as possible. No Aeronautical Material specifications (AMS) have been adopted by the SAE for nickel-chrome plating.

ARMY-NAVY AERONAUTICAL SPECIFICATIONS

Specifications AN-P-34 and AN-P-39

Minimum thickness on significant surfaces—

Type 1 (Decorative)	Final Nickel	.0005″
	Chromium	.00002″

Notes—

No requirements for preliminary copper deposits, either as a "strike" or in heavier deposits. Presumably copper may be used as a preliminary coating, provided final nickel thickness conforms to above.
Salt spray resistance—48 hours minimum.
Microscopic method for checking thickness is standard. Magnetic and spot tests may be used.
Significant surfaces are those touched by a ¾″ dia. ball.

FORD MOTOR COMPANY

Specification P-40

Minimum thickness on significant surfaces—

	Nickel	Chromium
Class D	.0001″	.00001″
Class E	.0004″	.00001″

Notes—

Class D coatings are for inside exposure—Class E coatings are intended for outside exposure.
No Salt Spray specifications for copper-base alloys.

BRITISH STANDARDS INSTITUTION

Specification 1224:1945

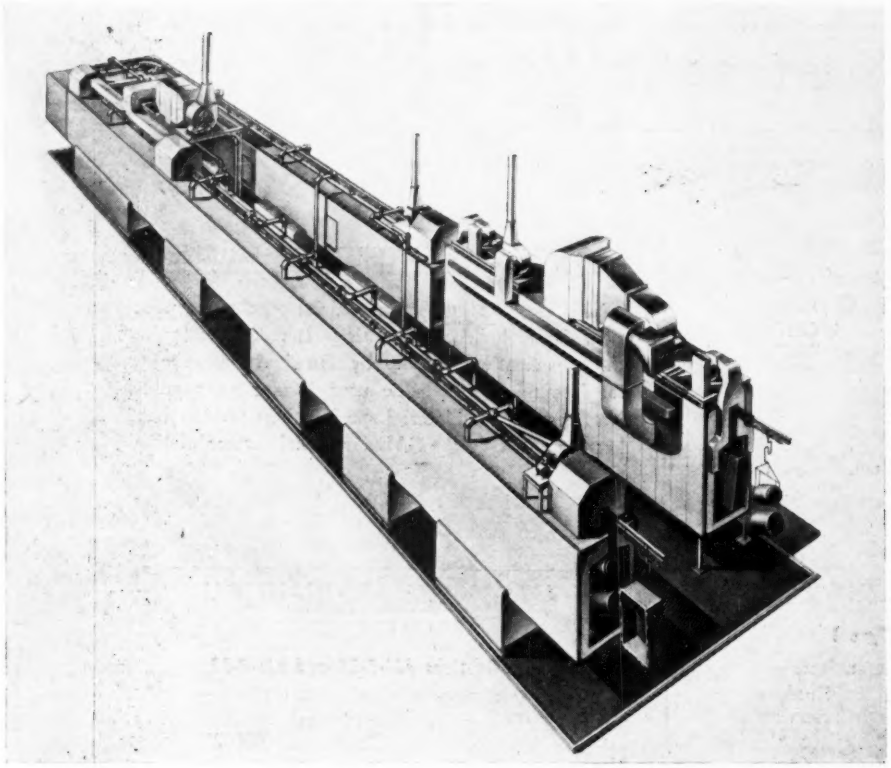
Minimum Thickness on significant surfaces—

	Class	Nickel	Chromium
Indoor use	Ni2C	.0002″	.00001″
Mild outdoor use	Ni3C	.0003″	.00001″
Severe outdoor use	Ni6C	.0006″	.00001″

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Completely Enclosed Washing and Pickling Machine



R. C. Mahon Co., Dept. MF, Detroit, Mich.

The new Mahon Hydro-Hermetic Seal (Patents Applied For) makes possible this noteworthy advance in the development of practical and economical equipment for the preparation of metal surfaces to receive porcelain enamel.

The process is continuous through all operations: Emulsion Cleaning, Clear Water Rinse, Alkali Cleaning, Three Stage Water Rinse, Sulphuric Acid Bath, Acid Water Rinse, Nickel Sulphate Bath, Sodium Cyanide Neutralizer, Borax Neutralizer Rinse, and Hot Air Dry-Off.

Tanks and tunnel housing are of mild steel throughout except in areas where corrosive materials are in contact or fumes prevalent. In these areas, steel is lined with lead or rubber, or Monel Metal is employed. The monorail conveyor, which operates in the open above the machine, is fitted with Monel Metal adapters which are the load carrying medium that passes through the Hydro-Hermetic Seal—no spray or fumes can escape or work up the adapters to damage the conveyor, it is claimed.

The Hydro-Hermetic Seal, which seals the top of this machine throughout its entire length, greatly increases processing efficiency in each stage. It also prevents the loss of active chemical fumes, reduces ventilating requirements to a minimum, and eliminates the necessity for a tremendous intake of air through an open conveyor slot—hitherto general practice, and the resulting necessity for replacement of air within the building.

These Mahon Pickling Machines can be designed to meet any requirement of product processing, production rate, or plant layout.

New Lead Alloy for Plating Industry

National Lead Company, Dept. MF, 111 Broadway, New York 6, N. Y.

This firm has recently announced a new lead alloy for use in the plating industry. Called Nalco Metal, the new alloy is designed to give considerably longer service than the alloys it has replaced in many installations, both in industrial plating and in decorative plating.

Nalco Metal is used for tank linings, anodes and heating-and-cooling coils and is substantially more resistant to the corrosive and pitting action of chromic acid solutions, it is claimed. With the new alloy anodic treatments of linings and coils are not necessary, such interruptions in production not being required to re-establish the lead chromate protective coatings on linings and coils of Nalco Metal.

In sheet form the new alloy is as easily cut, trimmed and shaped to the contours of the tanks as the lead alloys previously used, it is claimed. In pipe form Nalco Metal is readily coiled or looped and bound, clipped or blocked into units of any desired design or form. Further details are available on request to the above address.

Water Alkalinity Test Paper Set

LaMotte Chemical Products Company, Dept. MF. Towson 4, Baltimore, Md.

A valuable and interesting new test from the Development Laboratory of the above firm employs a series of new test papers for differentiating between Caustic Alkalinity, Carbonate Alkalinity and Bicarbonate Alkalinity of water and solutions. It is expected to find wide use in chemical manufacturing, power plants, process industries and any place where it is necessary to control the alkalinity of treated water. A compact and inexpensive kit is available, consisting of three vials of selected indicator papers which will quickly show whether the alkalinity of a solution is due to caustic, carbonate

ONE WORD ACHIEVEMENT in Buffing Economy...

Liquimatic®

LIQUID BUFFING COMPOUND

...and here are 7 Unique Features THAT ONLY LIQUIMATIC OFFERS

Fast cutting 1

Easy cleaning 2

Ability to develop adhesive, slow wearing buff face 3

Non-settling 4

High flash point 5

Long storage life 6

Sprayable viscosity 7

J·C·Miller Company *Manufacturers of* Electroplating and Polishing Equipment and Supplies

55 Mt Vernon N.W.
Grand Rapids 4, Michigan

Gentlemen:

During a lifetime of active participation in the finishing industry I have had the opportunity to see many changes take place. Many various types of Tripoli Compounds have been offered to the industry and by and large they have been pretty much alike.

For years, all buffing compound manufacturers have worked in earnest to produce a safe, efficient liquid compound that would cut better than bar compound, clean easily, promote long buff life and have good storing qualities. In probably all instances, save one, there are many highly desirable features still lacking in the liquid compounds now available.

Today, we here at the J. C. Miller Company have an important contribution to make to the trade in the form of Liquimatic, a development that will cause many highly beneficial changes in the industry.

I invite you to investigate Liquimatic, the completely new and already thoroughly proven liquid buffing compound.

Yours very truly,

J. C. MILLER COMPANY

President

mdr

Visit

BOOTH 2341

Upper Exposition Hall at the 31st National Metal Exposition and Congress – Cleveland, Ohio, October 17 - 21st. We'll be anxious to show you Liquimatic and the Liquimatiplier in operation.

LIQUIMATIC CONTAINS PURE SENECA STANDARD TRIPOLI

J. C. Miller COMPANY

GRAND RAPIDS 4, MICHIGAN

Spraying's Better...

For Buffing and Polishing!

Because:

1. Optimum quantity of composition always maintained on the buff—desired amount of composition is present for each piece buffed and assures proper cutting and coloring.
2. Spraying eliminates unnecessary wear—deficiency of composition causes excessive cloth wear.
3. Spraying with properly formulated compositions greatly simplifies cleaning after buffing with the proper types of cleaners.
4. From 50% to 75% less spray composition is needed for the same work as bar composition.
5. Spraying eliminates fire hazard by keeping the buff properly coated at all times—it's safe!

The Famous Siefen System is a Better Spraying System BECAUSE:

The Siefen System is designed by the finest engineers in their field. It's designed for your particular work and backed by the finest Spray Compounds on the market. Our Service is at your service—to increase your profits!

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SPRAY EQUIPMENT
SPRAY COMPOUNDS
SPRAY SERVICE

J. J. SIEFEN CO.

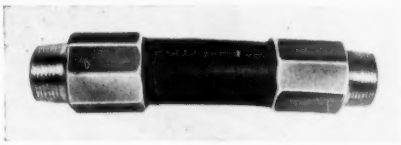
5641 Lauderdale
Detroit 9, Mich.

or bicarbonate. Complete instructions for using the papers are printed on the box.

Plating Tank Piping Insulator

True Brite Chemical Products Co., Dept. MF, P. O. Box 31 A, Oakville, Conn.

The True Insulator is an ideal answer for insulation of your steam and water coils—especially designed to give the maximum of protection to plating tanks from grounds and shorts, yet costs no more than "home-made" insulators.



The True Insulator is built with rugged male-threaded fittings on each end of a hexagon-shaped coupling for easy and fast installation to any water or steam line. Genuine rayon braid steam hose, which is covered inside and out with rubber, gives perfect insulation and long life with sufficient flexibility to enable attachment even on connections which are slightly out of line. The couplings have a permanent grip on the rubber, which will not cut or bulge even when used with high steam pressure or with repeated cycles of steam and water, it is claimed.

The True Insulator has been pretested for use on any steam line with up to 40 lbs. steam pressure or 125 lbs. water pressure—up to 80 lbs. steam pressure may be used with slightly decreased life expectancy, it is said.

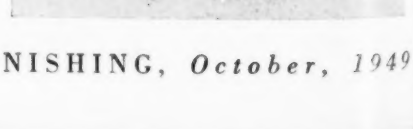
True Insulators are at present being sold by national distributors, but may be had by writing directly to the manufacturer.

Insulated Clips Now Standardized

Automotive Rubber Co., Inc., Dept. MF, 8601 Epworth Blvd., Detroit 4, Michigan.

Rubber insulated clips, clamps, and fasteners of various types have been standardized by this firm.

These rubber insulated products are



designed to prevent slipping, chaffing, cutting and rattling in the securing of wire, loom, tube, pipe, cable, rod, etc.

They are available in a variety of shapes and each in a wide range of sizes. Exposed metal ends can be parkerized, zinc plated, cadmium plated, lacquered or enameled to suit the customers needs. Special shapes and sizes are available to specification.

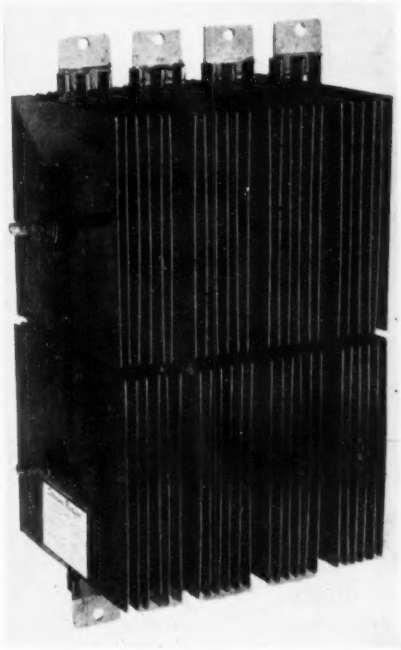
Introduction of insulated clips, clamps, and fasteners in standard sizes simplifies the engineering job and means definite economy and ease of buying in a number of industries and businesses.

Catalog sheets are available on request.

High Current Dual Rectifier Elements

International Rectifier Corp., Dept. MF, 6809 South Victoria Ave., Los Angeles 43, Calif.

One of the largest known dual selenium rectifier elements, measuring 7¼" x 12¾", has been developed by the above firm. Each dual element consists of two of the company's largest size 6¼" x 7¼" plates strapped in parallel and rated in a three phase bridge circuit at 34 amperes for continuous duty self-cooling, 85 amperes for continuous duty fan-cooling, and 340 amperes for highly intermittent duty. The stacks are designed on the basis of 16 K.W. per cubic foot and are provided with an interlocked assembly to prevent lug misalignment and plate rotation. They are covered



IT PAYS TO PRECLEAN with Magnusol

WHENEVER...

- you Clean after Buffing and Polishing; Drawing and Stamping; Machining and Grinding.
- you Want to Cut Down the Time of Exposure of Die Cast and Soft Metals to Alkaline Cleaners.
- you Have to Remove Slushing and Grinding Oils.

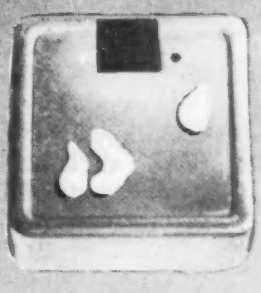
Precleaning with Magnusol solves the problem of removing stubborn dirts (particularly solid particles) which resist the action of vapor degreasing and alkaline cleaning solutions. It gives you a physically clean surface, ready for painting, lacquering or any other finishing operation which does not require a chemically clean surface.

If you must clean with an alkaline solution to provide a chemically clean surface for plating or vitreous enamelling, precleaning insures much more satisfactory results, with virtual elimination of rejects due to improperly cleaned surfaces.

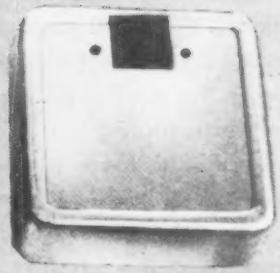
Precleaning with Magnusol is quick, easy and sure. Work is simply dipped or sprayed with a solution made up of one part of Magnusol concentrate and eight parts of kerosene or safety solvent, then drained and flushed clean with water. The Magnusol solution is harmless to *all* metals, non-toxic and non-flammable. The entire cleaning operation can be carried out at room temperature.

Write for recommendation on your cleaning operations.

Instrument case stamping before cleaning.



Precleaned with Magnusol (physically clean) ready for painting or for final alkaline cleaning.

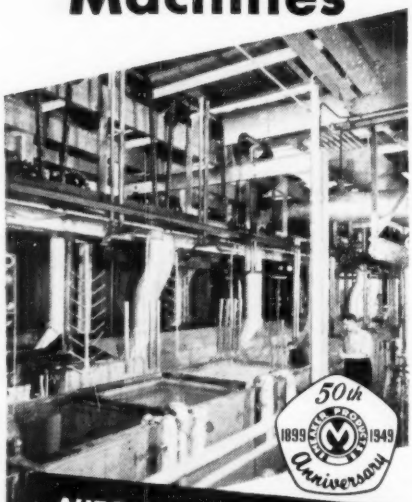


Electro-cleaned (chemically clean) with Magnus 94XX after precleaning, ready for plating or vitreous enamelling.

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.
Service representatives in principal cities

IN METAL CLEANING IT'S Magnus
CLEANERS • EQUIPMENT • METHODS

MEAKER
Electroplating Machines



AUTOMATIC MACHINES
STRAIGHT-A-WAY and RETURN TYPE
for mass production of
large or small pieces

SEMI-AUTOMATIC MACHINES
For supplementary capacity
or medium output departments

SPECIAL MACHINES
For any special plating
or cleaning sequence

Equipment tailored to fit your requirements, making every operation in the plating sequence automatic, or as mechanized as possible, is the profitable way to handle electroplating on a production basis. This Meaker method applies equally well to departments with only moderate daily output and to the largest and heaviest plating needs of the mass production plants. It offers not only a lower unit cost, but the production is increased, and a better and more uniform quality is assured.

Write for the full information. Ask for Booklet 148

THE MEAKER COMPANY
1635 South 55th Ave., Chicago 50, Ill.
Telephone CRawford 7-7202

with a multiple dipped black coating for improved heat radiation and protection against high humidity, excessive moisture, and other adverse atmospheric conditions. Operating efficiencies of 85% can be obtained, it is claimed, and when aluminum plates are used, the weight per dual element minus the hardware is 9 ounces. Each 1500 ampere stack is 7¼" wide by 12" long by 14½" high.

New Ultrasonic Generator

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new ultrasonic generator, providing a simple and practical method for studying the effect of ultrasonic energy on various materials and processes, has been announced by General Electric's Special Products Division.

The generator converts high-frequency electrical power into high-frequency mechanical vibrations in the form of sound waves pitched considerably higher than the range of human hearing. It permits a wide operating range by providing four vibration frequencies: 300, 500, 750, and 1000 kc.

Many possible applications in ultrasonic research are offered by the new instrument. Biologically, experimentation can be done on the destruction of some bacteria and the increase in virulence of others. Physically, the transforming of immescible liquids into stable emulsions and the colloidal suspension of precipitates in liquids can be examined. Investigation into chemical reactions such as oxidation, hydrolysis, and reduction is possible with the new generator.

Entirely self-contained in a steel console, the equipment consists of a power unit and a transducer assembly. The transducer assembly is mounted on top of the cabinet. It consists of a transparent cylinder to hold insulating oil around the high voltage leads coming from the electronic circuit to the crystal. The transducer, or crystal, forms the bottom of a test well which is immersed in the insulating oil. Material to be tested is placed in a suitable container—a beaker or test tube—within this well and is directly exposed to vibrations from the crystal.

Standing 45-in. high, the ultrasonic generator is 21 in. wide and 19 in. deep. The test well measures 1¾ in. in diameter and has a depth of 2⅝ in. Power input is 500 watts at 115 volts, 50 cycles, while power output is 200-250 acoustical watts.

Nickel and Chrome Pre-Plated Round Edge Flat Wire

American Nickeloid Co., Dept. MF, Peru, Ill.

This firm has recently announced the availability of round edge flat wire furnished in Nickel or Chrome finish on steel base. This material finds wide usage among manufacturers in such decorative and functional uses as trim, furniture parts, toys, trunk hardware, displays, and in pinball machines.

Known for its smooth edges, narrow widths, heavy gauges and rigidity, round edge flat wire is available finished on one or both sides. It is furnished in .035" to .125" thickness, and 3/16" to 2" widths. Standard length in Nickel finish is 71" or 142" cut into two parts, no one part exceeding 95". In Chrome finish, lengths are 70" or 140" cut into two parts, no one part exceeding 94".

Inquiries may be directed to American Nickeloid's home office in Peru, Ill., or to any of its sales offices located in all principal cities.

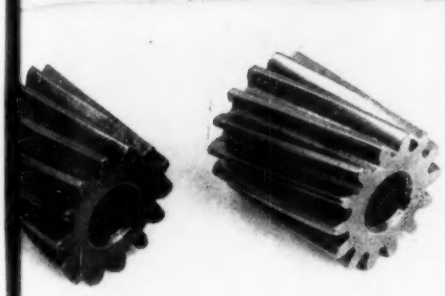
Air-Operated Control Instruments

The Bristol Co., Dept. MF, Waterbury, Conn.

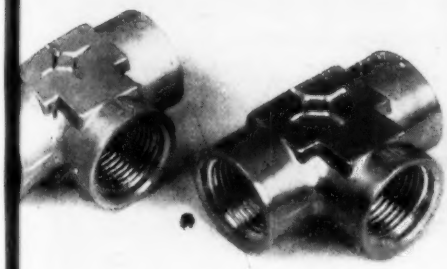
A new line of air-operated control instruments, known as the Series 500 Controllers, has been announced by the above firm. Included are controllers for automatically controlling temperature, pressure, flow, liquid level,

SLASH FINISHING COSTS UP TO 95%
WITH AMERICA'S MOST VERSATILE
PRECISION BARREL FINISHING PROCESS

THE DIFFERENCE IS SUPERSHEEN



THE DIFFERENCE IS SUPERSHEEN



ABOVE PHOTOS ARE UNRETOUCHED

ALMCO **Supersheen***

- Some manufacturers report their ALMCO SUPERSHEEN equipment paid for itself in ONLY ONE OR TWO MONTHS!
- We know of no installation that hasn't paid for itself in less than a year!
- A single unit installation will replace from TWO TO TWELVE MEN.
- ALMCO SUPERSHEEN equipment is used by the nation's leading manufacturers.
- ALMCO SUPERSHEEN equipment is enabling manufacturers in many fields to reduce costs to an extent they never thought possible.
- AND, the ALMCO SUPERSHEEN process consistently produces . . .

*A Better Finish-FASTER

"COMPLETE" IS THE WORD FOR OUR SERVICE AND EQUIPMENT

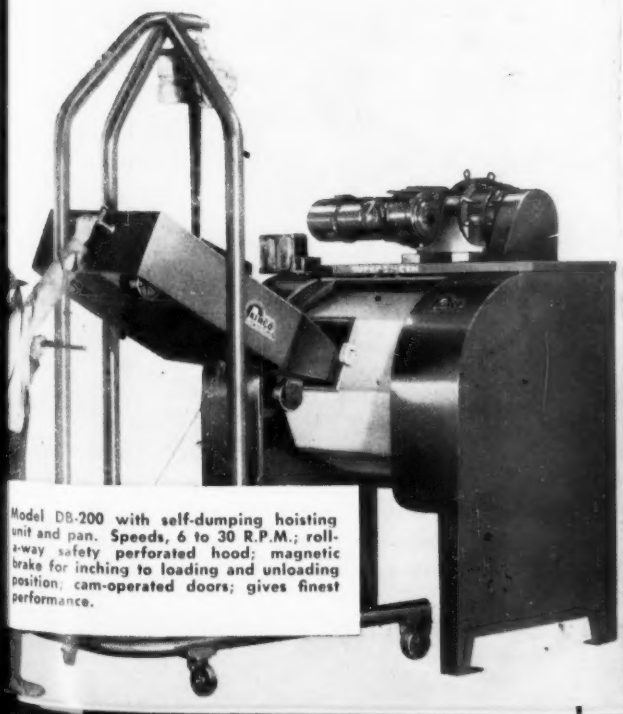
- ***THE MOST COMPLETE LINE ON THE MARKET***

(1) Advanced Design *Precision* Tumbling barrels in sizes from 8" x 16" up to 60" x 30"; (2) *Automatic* loading, unloading and separating equipment; (3) A vastly *superior* grinding and finishing medium in 2 grades and 9 sizes.

- **FREE ENGINEERING CLINICS**

Nationwide Network of Engineering Clinics provide you with *quicker* and *better* sample processing—Keep you fully informed of latest methods. Write today for full details—or send unfinished samples for FREE Engineered Pilot Run and complete production cost data. Include finished part for guide.

ALMCO DIVISION
QUEEN STOVE WORKS, INC. — ALBERT LEA, MINN.



Model DB-200 with self-dumping hoisting unit and pan. **Speeds, 6 to 30 R.P.M.; roll-a-way safety perforated hood; magnetic brake for inching to loading and unloading position; cam-operated doors; gives finest performance.**

FREE SAMPLE PROCESSING ■ GET FACTS TODAY

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SUPERIOR FINISHES PROVE THE SUPERIORITY OF *SPEEDIE!*

SPEEDIE Stainless Steel and Chrome Compositions

For fast, economical cutting down and coloring of all types of *stainless steel* and *chrome,* nothing surpasses *SPEEDIE* Stainless Steel and Chrome Compositions. They have been job-proved through the years for cutting down and to give maximum color per degree of cut.

Learn more about the many other *SPEEDIE* "laboratory-quality", job-proved products — Tripoli, Nickel Finish, Satin Finish, Emery Cake, Grease Stick, etc. Write Dept. M.F. for your FREE catalog today.

- CUT AND COLOR IN ONE OPERATION
- FAST, GENTLE CUTTING ACTION
- MAXIMUM COLOR PER DEGREE OF CUT
- CLEANER WORKING — LESS WASTE
- 5 SPECIAL COMPOUNDS AVAILABLE
- ALL 100% SAPONIFIABLE

Polishing Room Supplies and Accessories

BP **THE BUCKEYE PRODUCTS CO.**
7033 Vine Street Cincinnati 16, Ohio
Cable address: Buckprod

humidity, and pH value. The new controllers have calibrated control actions. Reset rate, derivative time, and proportional band adjustments are accurately calibrated and reproducible. They have only one service adjustment. Controllers can be completely disassembled and after being reassembled, with replacement parts, only one adjustment is required to put the system in exact calibration, it is claimed. All Series 500 Reset Controllers are equipped with reset action stops.

The new instruments are offered in five types of control action: on-off, proportional, reset, derivative, and reset plus derivative. The instruments are readily convertible from one type to another.

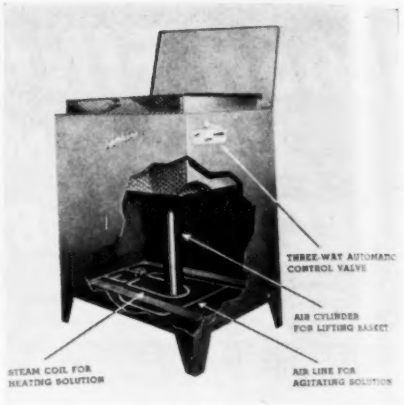
Air-Operated Dip Tank for Cleaning Metal Parts

Hopkins Equipment Co., Dept. MF, 54 Maple Ave., Hatfield, Pa.

A new, completely automatic dip tank for fast, thorough and economical cleaning of metal parts is announced by the above firm.

The "Dip-O-Matic" eliminates all manual labor in its operation. A three-way finger-tip control air valve does the work, automatically lowering and raising the specially designed basket into the solution.

Metal cleaning action is twofold. Old fashioned soaking action helps


THREE-WAY AUTOMATIC CONTROL VALVE
AIR CYLINDER FOR LIFTING BASKET
STEAM COIL FOR HEATING SOLUTION
AIR LINE FOR AGITATING SOLUTION

loosen dirt and grease. New agitated-solution action actively washes parts and releases stubborn dirt and grease that will not soak free, it is claimed.

There are no motors—fire hazards are eliminated. There are no pumps or gears to wear out. Steam heat maintains the cleaning solvent at proper temperature, or cold solutions may also be used. Automatic temperature controls are optional equipment.

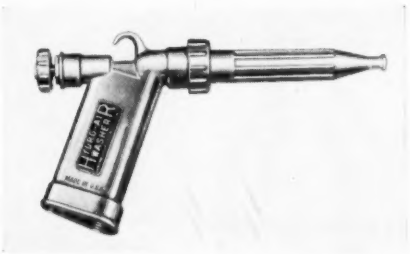
Floor space occupied by the "Dip-O-Matic" is only 2 feet by 3 feet.

New Pressure Washer Gives More Versatile Cleaning Performance

D & M Products, Inc., Dept. MF, 439 S. Western Ave., Los Angeles 5, Calif.

An improved model of the Hydro-Air pressure washer, with a broadened range of applications to industrial and automotive cleaning jobs, has been announced by this firm.

Faster, more efficient cleaning action with the washer has been obtained by a redesign of the air orifice and ven-



turi tubes, permitting the utilization of an increased volume of air and water, it is claimed.

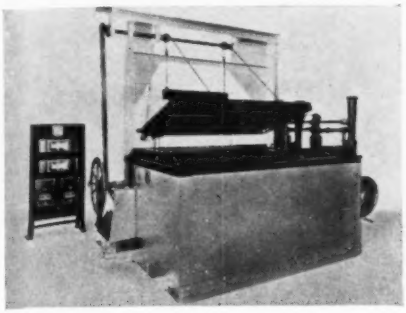
The Hydro-Air washer uses a mixture of water and compressed air which can be precisely controlled. Through the use of varying adjustments, the washer can effectively remove heavy dirt and grease or quickly and thoroughly rinse cleaning solvent from sheets and parts without backsplash or harm to finish, according to the firm.

Descaling Furnace

James H. Knapp Co., Dept. MF, 839 E. Fourth St., Los Angeles 13, Calif.

This company is manufacturing a new portable, I-beam based, gas-fired salt bath for descaling processes on stainless steel parts. It can be fired with natural, artificial or any of the LP gases.

The welded steel bath is heated by two immersion tubes equipped with air operated eductors to insure proper travel of gases, and operates around



930°F. The unit is encased in a heavily insulated steel shell. A motor driven hinged lid covers the top and is arranged with limit switches and up and down push-button station, or may be operated manually if desired.

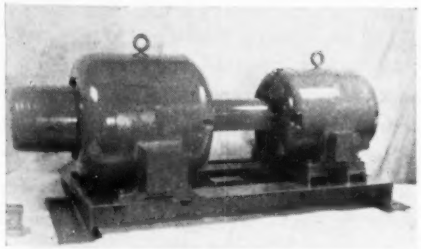
All burners are electrically ignited and have flame failure cutouts. Heat is regulated by an automatic temperature indicating control and over-temperature cut-out.

Motor Generators

Kato Engineering Co., Dept. MF, 1415 First Ave., Mankato, Minn.

This firm has recently announced a new series of motor generator sets. Katolight motor generator sets are available for changing D.C. to A.C., A.C. to D.C., or from one frequency to another frequency as many manufacturing industries today require other than standard frequencies and voltages.

Motor Generator sets are available in sizes up to 300 KW, from 15 cycles



to 400 cycles. The Kato Engineering Company invites inquiries for all kinds of Motor Generator requirements.

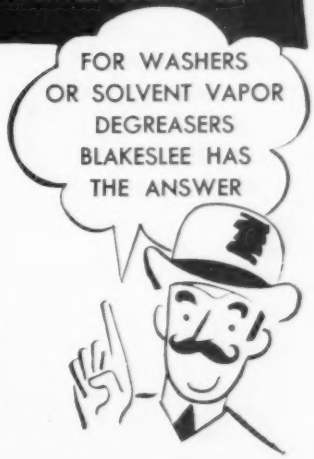
Since the days of the Tandem Bike...

BLAKESLEE
HAS PIONEERED
METAL PARTS WASHERS

In the days when handle bar mustaches, derby hats and celluloid collars were popular . . . Metal parts were already being washed in Blakeslee washers.

Blakeslee engineers are constantly improving cleaning methods and speeding up cleaning operations to keep pace with modern mass production methods. Experience in handling every metal piece, from small watch parts to Diesel engine crank cases, has given Blakeslee engineers the "know how" to solve your particular cleaning problems.

A qualified Blakeslee representative is located near your plant. Write, wire or phone and he will be pleased to discuss your cleaning problems with you.



G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N.Y. TORONTO, ONT.

Room De-Humidifier

Fisher Scientific Company, Dept. MF, 717 Forbes Street, Pittsburgh 19, Penna.

High humidity, corrosive to equipment, objectionable in weighing deliquescent materials, and enervating to personnel, can be eliminated by use of a new De-Humidifier which is capable of controlling moisture in a room of 8,000 cu. ft. volume.

The new De-Humidifier consists of condensing and evaporating coils with motor-driven fan and receptacle for condensate, all housed in a compact unit 14 in. in diameter by 34 in. tall. In very humid conditions, it will remove as much as 12 to 14 gals. of water per 24 hours.

Operation of the De-Humidifier is recommended whenever dew point is above 50 deg. F. or dry bulb reading of hygrometer is above 65 deg. F. Compressor is driven by 0.125 hp. motor and fan which draws air into unit, has a 0.01 hp. motor.

TODAY'S BEST BUY

for Setting Up POLISHING WHEELS AND BELTS

GRIPMASTER PATENTED POLISHING WHEEL CEMENT

LEADING PLANTS REPORT:

GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!

Now! **Longer Wheel Head Life!** Thanks to Gripmaster's special high-heat resisting ingredient!

Now! **Fewer Stops for Wheel Changes!** Gripmaster *locks in* grains of emery "vise tight!"

Now! **Inventories Simplified!** One grade grips *all* grains—300 to 20. No special sizer needed!

Now! **Better Finishes!** Greater flexibility gives more and finer "breaks" when wheel is "cracked!"

Now! **Goodbye to S. O.!** There's no Stockyards Odor in Gripmaster. It's clean, odor-free!

"First Choice of the World's Best Finishers"

YOURS FOR THE ASKING

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☐ Send us a generous FREE SAMPLE of Gripmaster.
☐ Send us data on how to boost polishing production.
☐ Have a representative call to demonstrate.

MF1049

COMPANY_____

ATTENTION_____

ADDRESS_____

CITY_____ STATE_____

Cut Wire Steel Shot

Precision Shot Co., Dept. MF, 6432 Cass Ave., Detroit 2, Mich.

Recently introduced to industry is the new "Cutwire Shot" for peening and cleaning. It is made from high quality SAE 1065 wire for high tensile strength, hardness (C 46-52 Rockwell), and maximum fatigue resistance, and is now available in .014"-.072" dia.

Life of Cutwire shot is said to be 1500 cycles, as opposed to the 2½-10 cycle life of the conventional chilled iron shot. Other advantages claimed are uniformity of physical properties and maintenance of size, and users are said to be saving 20 to 40% in machine maintenance.

Cutwire shot quickly deforms into a full round shape of uniform size, which is claimed to be maintained for 98% of its long period of use.

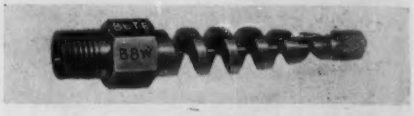
Spray Nozzle

Bete Fog Nozzle Co., Dept. MF, Greenfield, Mass.

A new spray nozzle which operates on a radically different principle has just been announced by this manufacturer.

The new line of Bete spray nozzles, on which several patents are pending, has a unique spiral design that produces a finer atomization yet is practically non-clogging, according to the manufacturer.

The new Bete nozzles shear from a single, high-velocity jet a continuous film which readily breaks up into uniformly fine particles at relatively low pressures.



No vanes nor whirl discs are required with this new type of nozzle, as they are with most conventional nozzles.

The Bete Company is now producing the new type nozzle in various spray patterns and with flow rates from one-quarter gallons per minute to 100 g.p.m. They can be used for all kinds of spray problems where a fine break-up at low pressures is required.

Drum Rotator and Truck

Morse Mfg. Co., Inc., Dept. MF, 122 Dickerson St., Syracuse, N. Y.

Recently announced by this firm is their novel drum rotator and truck which can be used for moving and mixing drum loads of materials. Known as the Rotator, the unit is complete with motor and drive, and is adaptable to various sizes of drum-shaped containers from 1 gal. to 55 gals. in size, it is claimed. With this apparatus one man can easily handle full drums of materials, lifting them onto the truck by means of the tipping lever, and thoroughly mixing the contents when necessary by turning on the motor drive. A choice of rotating speeds is available, and the change-over to accommodate various sizes of drums can be made in a few minutes, according to the manufacturer. The construction of the truck and rotator is rugged, including a ½ H.P. motor, gear box, and sealed ball bearings. Other features are rubber shock mounts, flexible couplings, swivel casters, and an all-welded steel frame. Further details are available by writing to the manufacturer at the above address.

New Surface Treatment Chemical for Aluminum, Steel and Zinc Surfaces

Enthone, Inc., 442 Elm Street, Dept. MF, New Haven, Conn.

This firm has announced the development of a new-type surface preparational material called "Surprep" for cleaning surfaces, especially prior to organic finishing. This product is a liquid that contains oil-displacing chemicals that are claimed to quickly

dislodge oil, grease and other organic material from the surface of metals so that they can be quickly rinsed off with water or wiped off with a cloth. The material also contains phosphating and other rust-removal chemicals that quickly dissolve rust, oxide and scale while the oil removal agents are operating, it is claimed.

The application of "Surprep" is relatively simply. It is used either full strength or diluted with water. It is applied by brushing with a paint brush or wiping with a cloth. After the material has stood for several minutes, the surface can be wiped off with a cloth and it is then ready for painting, according to the firm. The surfaces can also be hosed off with water and then wiped dry. The surface is given a uniform etch and a light phosphate film is deposited which gives an excellent tooth for the paint or organic finish, resulting in greatly increased bond strength, it is said. No toxic vapors are evolved during the use of the cleaner.

It is supplied in one-gallon jugs, five and twelve gallon carboys, and fifty-gallon barrels.

How to have a better-looking plant and SAVE on maintenance

UCILON Protective Coating Systems stop corrosives —give life-saving protection to metal, concrete, wood!

Of course you can have an attractive plating department and cut costs too. For when you apply Ucilon Coating Systems, you get a job that stands up despite the strong corrosives and excessive moisture.

One well-known company, for instance, had its entire plating department protected with Ucilon coatings—including tanks, walls, concrete floor, ducts. These coatings have resisted attack for better than *two years*—and they're good for much more!

Ucilon Coating Systems resist continuous contact with acids, alkalies, water, cleaners, as well as fumes and splashing from plating baths. Spray or brush them on wherever corrosion is costing *you* money. Ucilon coatings are helping hundreds of concerns to maintain equipment in tip-top condition while reducing frequency and expense of painting. To learn how they do it, send today for this 32-page booklet on corrosion control with Ucilon Coating Systems.

UCILON* Protective Coatings

UNICHROME products of UNITED CHROMIUM, INCORPORATED

51 East 42nd Street, N.Y. 17, N.Y. *Trade-Mark Reg. U. S. Pat. Off.

Detroit 7, Mich. • Waterbury 90, Conn. • Dayton 2, Ohio • Chicago 4, Ill. • Los Angeles 13, Calif.

All-Vision Dust Mask

Mine Safety Appliance Co., Dept. MF, Pittsburg 8, Pa.

The new M.S.A. All-Vision Dust Mask which provides complete facial and respiratory protection against nuisance and harmful dusts is a recent development of the Mine Safety Appliances Co.

Fitted with a lightweight, flexible all-rubber facepiece, the mask conforms snugly to the contours of the face, forming a comfortable, gas-tight seal. Easily adjusted head bands secure the mask to the head without binding, facilitate quick attachment and assure wearer comfort.

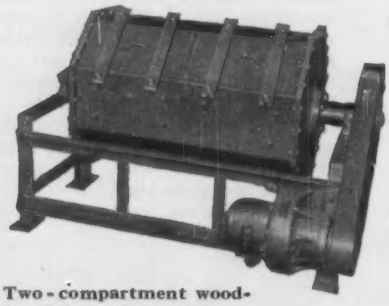
This new M.S.A. Mask is claimed to afford the maximu min low breathing resistance by means of a large-area,

inexpensive, throw-away filter which can be quickly replaced as required. The filter container is sturdy, lightweight aluminum and is situated low on the mask for unobstructed vision.

A TUMBLING BARREL FOR EVERY PURPOSE

Yes . . . Henderson can supply you with tumbling equipment in a variety of sizes, shapes and materials for practically every tumbling requirement. Nearly three quarters of a century in designing and manufacturing tumbling barrels for the GRINDING, BURNISHING, POLISHING and CLEANING of metal stampings, balls, bearing races, forgings, small castings, screw machine products, jewelry, wire forms and small metal parts. Tilting type barrels of Steel, Wood or Alloy Metal . . . Horizontal type barrels of Cast Iron or Cast Steel. Wood or rubber lined in all Models. Also special barrels for plastics.

#5A Motor Driven Tilting Oblique Tumbling Barrel.



Two-compartment wood-lined Burnishing Barrel.

If your requirements call for faster production and finer quality at lower cost or if you require Tumbling Barrels of special design, our Development and Engineering Service will be glad to make recommendations.

Write for further information.

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Large, clear lenses permit natural, wide-angle vision, and lenses are protected from fogging by unique inner air deflectors.

New Rubber-Like, Chemical-Resisting Plastic Compounds

United Chromium, Inc., Dept. MF, 51 East 42nd Street, New York 17, N. Y.

Rubberlike plastic materials, which are said to possess many chemical properties lacking in both natural and synthetic rubbers, have been developed recently by the Organic Coatings Division of United Chromium, Inc. These new materials are known as Unichrome Plastisol and Organosol Compounds. Their advantages include outstanding resistance to a wide variety of chemicals and corrosives, excellent resistance to mechanical abuse such as abrasion, high dielectric strength, and easy handling.

The development of this general line of plastisols and organosols follows more than two years of experience in producing plastisols for insulating electroplating racks. The present line of products was developed in response to requests from engineering and design department for materials in a variety of colors with slightly different physical and chemical properties than those of the plastisols used so successfully by the plating departments within their organizations.

Unichrome Plastisols and Organosols are delivered in paste-like form. The plastisols contain 100% solids, while the organosols contain a small percentage of liquid solvent or diluent. They can be molded or they can be applied as coatings to metal, fabric, or paper by dipping, spraying, or brushing. Upon baking at a temperature of about 350°F. for 20 to 30 minutes, the materials set and take on a rubber-like appearance. The cured compounds resist acids, alkalies, salt solutions, oils, gasoline greases, industrial oxidants, and a number of other types of chemicals and products normally corrosive to rubber, it is claimed. Coatings from .003" to .25" may be obtained with a single application.

Because these rubber-like Plastisols and Organosols are said to have such excellent resistance to corrosive chemicals and mechanical damage, they appear suited for a wide variety of applications. They have already been found to be particularly advantageous when used on pipes, tanks, drums, work carriers, tool handles, cotton gloves, protective clothing, and process equipment subject to strong corrosives.

Filtering System for Plating Tanks

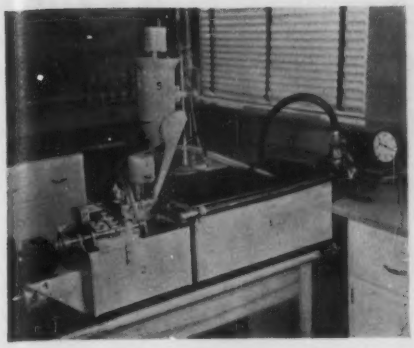
The Commonwealth Engineering Co. of Ohio, Dept. MF, Dayton, Ohio.

High operating efficiency with a minimum of maintenance attention is the principal feature of a new filtering system design perfected by this firm, an applied research and development engineering organization.

The design provides a unit which is claimed to act as an automatic, self-renewing filtering system adaptable to permanent installation in electroplating and other processing setups to completely remove solid impurities in continuous or intermittent operation as desired.

The completely automatic system works efficiently with all types of solutions, it is said, even difficult slimes such as those from cyanide plating tanks, and those composed of iron and aluminum hydrides have been successfully filtered. These substances are removed in a condition which makes recovery of metal content easy.

The central idea of the development is the passage of the solution through a layer of filter which is removed as rapidly as it becomes clogged with im-



purities, and immediately replaced with fresh material.

As developed in the laboratory apparatus, a revolving drum—with perforated cylindrical surface—is coated with a filter aid of a diatomaceous or comparable type. The drum is submerged in the filter tank which is directly connected by piping to the plating tank. The solution passes through to the interior of the drum under the influence of suction supplied by a pump, and impurities are trapped in the filter cake. Clear filtrate returns to the plating tank.

To accomplish the self-cleaning function, the drum revolves against a blade set at the top to remove the spent filter layer, which is transported up a ramp and dropped to a disposal container.

Immediately back of the blade is the slurry chamber in which filter aid is received from a hopper above and diluted with fresh solution from the plating tank. The aid deposits itself on the drum in the small segment exposed to the chamber to replace the spent layer as the latter is removed.

An electrical control system applied to the apparatus regulates the intermittent rotation of the drum and slurry mixture to meet the requirements of the filtering operation.

The new filter design solves such special problems as preventing a glazing effect upon the filter coating, and cake management under widely varying conditions of operation, it is claimed. Unusually high flow rates have been achieved in the new design, which has been brought to the point of application to production scale equipment. Using aqueous solutions, the pilot apparatus in sustained operation has reached a flow of five gallons per minute per square foot of filter.

CHROMIC ACID

99.75% PURE

SODIUM BICHROMATE
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POTASSIUM BICHROMATE

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270 Madison Avenue, New York 16, N. Y.

Corrosion Resisting Plug Valves

Duriron Co., Inc., Dept. MF, Dayton 1, *O.*

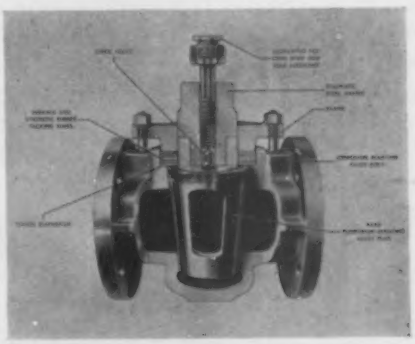
A new line of Durco plug valves has been developed by this firm for heavy duty corrosive service.

The new features of the Durco Type A Valve are:

1. A composite plug. The plug proper is made of a *hard* corrosion resisting alloy, such as Duriron or Durichlor. The shank is made of stainless steel permanently bonded into the plug. The hard plug with an unbreakable plug shank gives positive mechanical operation.

2. The body and gland are made and regularly stocked in Durimet 20. This alloy provides ample strength and excellent general corrosion resistance. Other alloys are also available on special order for special corrosive applications.

3. The packing for the stuffing box



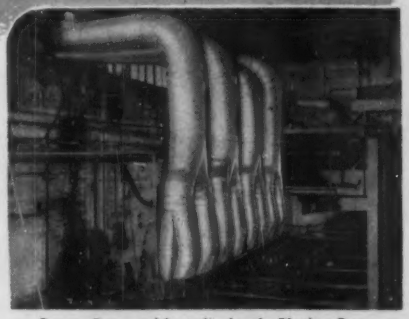
Type A Plug Valve.

Ohio FUME AND DUST REMOVAL SYSTEMS
TANGIBLE DOLLAR SAVERS

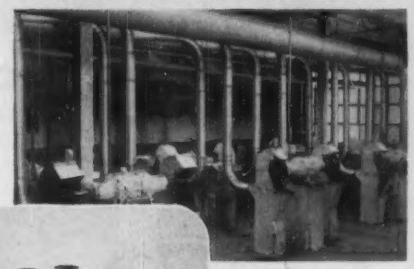
● Records on hundreds of Ohio Blow Pipe jobs prove without question that production output materially increased and employee absence and complaints radically decreased after the installation of an Ohio System for ventilation of fumes from plating and rinse tanks and dust collection from grinding, polishing and buffing.

Ohio Systems are not standard fit-all systems. They are designed and engineered to meet your individual requirements. Ohio engineers, thoroughly experienced in their field, make a careful, exacting survey of your plant and an analysis of conditions and then plan the system that will meet most efficiently your special needs and conditions.

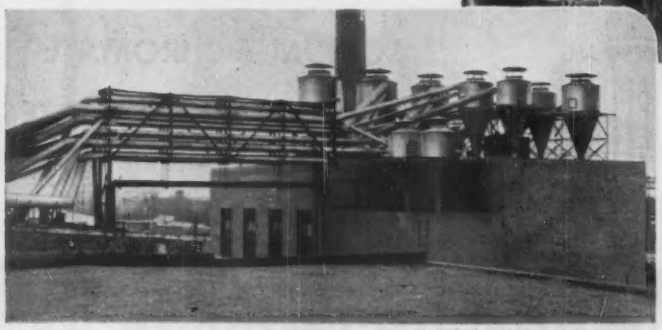
Call, write or phone today and let Ohio engineers make a survey and give you, without obligation, an estimate.



Fumes Removal Installation in Plating Room



Dust Collecting System for Buffing Machines

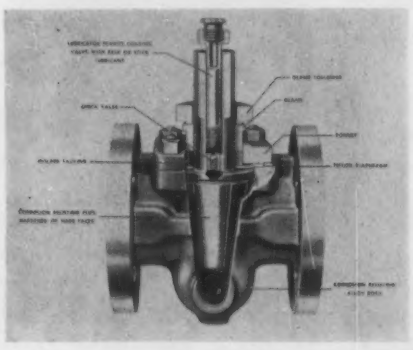


Cyclone Type Dust Collectors

Ohio BLOW PIPE CO.
ENGINEERS AND MANUFACTURERS
1725 DOAN AVENUE • CLEVELAND 12, OHIO

consists of a combination of corrosion resisting hard and resilient packing rings and a Teflon anti-friction packing seal.

All Durco Type B Plug Valves have these features:



Type B—Top lubricated.

1. Wide range of corrosion resisting alloy bodies: Durimet 20, Chlorimet 2, Chlorimet 3, Durco D-10, Pure Nickel, Inconel, Monel and Ni-Resist.

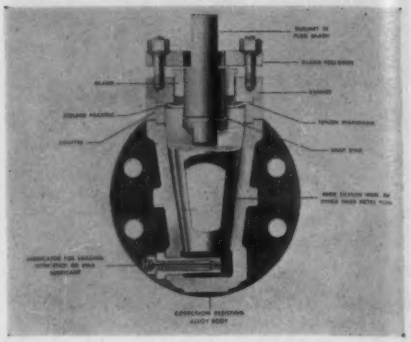
2. Hard, hardened or hard-faced plugs with grooves *cut* after grinding and lapping.

3. Teflon diaphragm to provide a completely corrosion resisting self-lubricating seal.

4. Provision for lubrication with bulk or stick lubricant.

5. Proper plug taper, grinding and lapping for good continuous seating, long life and positive mechanical operation in corrosive service.

The Top Lubricated Durco Type B Valve has the lubricator in the plug shank. The plugs are hardened or hard-faced.



Type B—Bottom lubricated.

The Bottom Lubricated Durco Type B Valve (used where plugs are too hard to machine readily) is provided with a lubricator in the body, below the plug. The plug is flexible jointed, the plug proper being made of Duriron, Durichlor or other hard corrosion resisting metal, while the plug shank is made of Durimet 20. The shank is permanently assembled into the hard alloy plug. This design prevents the transmission of shock from shank to plug and also provides the best material of construction for each part of the plug assembly.

Buffer Solutions for Calibrating pH Instruments

Leeds & Northrup Co., Dept. MF, 4934 Stenton Avenue, Philadelphia 44, Pa.

A new line of buffer solutions for calibrating any pH instrument is announced by this firm. Nominal pH values are 4, 7, and 9; actual, 4.01, 6.86, and 9.16 at 25 C. Solutions are supplied in 1 pt. unbreakable, noncontaminating, re-useable polyethylene bottles on which are printed pH-temperature calibrations from 0 to 60 C. Buffers are made, and checked after bottling, to National Bureau of Standards specifications.

Vacuum Etching Developed by Ford Engineers

A revolutionary new etching process to prepare metal surfaces for microscopic examination and photography has been developed by the Ford Motor Company. The unique metal-etching method, never before used in industry, utilizes ionized atoms. The process is known as cathodic vacuum etching.

Etching is widely used in industry to examine metal structures for determining quality and aiding in development of new materials or manufacturing processes. Cathodic vacuum etch-

ing has brought an important improvement. It enables the taking of an unusually clear photograph of flow lines —a curious strata-like pattern which indicates the direction the metal flowed when forged under high pressure.

The new etching technique works this way: The metal sample is placed in a partial vacuum with argon, a rare gas found in the air. Twelve thousand volts of electricity are charged into the

Metal sample being tested by Don M. McCutcheon, of the Ford applied physics research department. The metal is placed in a partial vacuum containing argon, a rare gas, and a charge of 12,000 volts of electricity is sent into the vacuum. This creates argon ions which bombard the metal's surface, knocking off minute particles and bringing out the true microstructure of the metal with greater detail and clarity.

vacuum, creating argon ions which bombard the metal surface and knock off minute particles. Under the newly developed method the physical features of metal can be examined under a microscope and measured accurately as to their effect on strength and performance in whatever part of the Ford cars the metal ultimately will become a fixture.

Flow lines in steel samples previously undetected now have been revealed by cathodic bombardment. Comparison of the structure pattern produced by the best chemical etching method revealed that the new cathodic treatment brings out the true microstructure of the metal with greater detail and clarity.

A special pressure-rolled Ford front wheel spindle was examined experimentally by the usual microscopic technique. No superficial layer of flowed metal could be detected by the chemical etching process. However, cathodic bombardment etching revealed the entire superficially rolled structure, showing individual flow lines which indicated that deformation was only .005-inch deep.

Results also were obtained which indicate that grain structure of metals also can be more clearly shown by cathodic bombardment. Ford engineers have begun an extensive program to explore this phase of cathodic etching.

STOPS CORROSION LOSSES

RESISTS ACIDS, ALKALIES, WATER, ALCOHOL, OILS, GREASES

EASILY APPLIED WITH SPRAY OR BRUSH, DRIES QUICKLY

CORROSION goes hungry in the plant protected by Tygon Paint. This remarkable coating, proven over a ten-year period, forms a "live" plastic film so tough that corrosion can't eat through. Its use cuts maintenance costs to the bone, adds extra life to any equipment subjected to corrosive fumes, condensates or spillage. Write today for your free copy of Bulletin 709.

Resists Acids, Alkalies, Oil, Water, Alcohols • Applied by Spray Gun or Brush • Air Dries Quickly • Non-toxic and Non-Flammable when dry • Will not oxidize, flake-off or chip.

U. S. STONEWARE
Akron 9, Ohio

Substitute for Palm Oil for Hot Dip Tinning

Research scientists at Armour Research Foundation of Illinois Institute of Technology are achieving successful laboratory results expected to have wide economic importance to the steel industry.

William R. Johnson, research metallurgist, *Layton C. Kinney*, supervisor of chemical engineering, and *John M. Parks*, supervisor of non-ferrous metallurgy, have developed a synthetic substitute for African and East Indian palm oil, a vital necessity in making hot dip tinplate. Mill tests will soon be run.

There is no domestic source of this palm oil, and, up to now, no substitute in general use.

About 7,500 tons of the oil are used annually in the United States in hot dip tinning. All of the oil must be imported from North Africa or the

There are Many Black Finishes

but only ONE DU-LITE

Many manufacturers have had to learn the "hard" way that Du-Lite is *the* trouble-free, easy-to-operate black finishing process, producing a uniform, intense black finish. Du-Lite is a standard, specified finish for tools, guns, gun parts, photographic, optical, and precision equipment parts where an attractive rust-resistant finish is needed. But that is not its only use . . .

Used By Leading Aircraft Engine Builders As An Aid To Lubrication

Du-Lite is used extensively by engine builders to black finish bearing surfaces before assembly. It might be said, "Why finish these highly polished surfaces?" The reason, and practical too, is that Du-Lite processing rounds off the microscopic spines and edges present on even highly polished surfaces of metal without causing any dimensional change.

Furthermore this Du-Lite black oxide finish is oil-absorptive, rust-resistant, and acts as an aid to lubrication during the breaking-in period, reducing the possibility of galling and scoring.

Investigate Du-Lite for use on your products. Call or write the main office at Middletown and a qualified technical man will call on you.

DO IT RIGHT WITH DU-LITE
Write or Phone Today

The DU-LITE CHEMICAL CORP.
110 RIVER ROAD -:- MIDDLETOWN, CONN.

East Indies over long shipping lanes. Supplies were greatly curtailed during World War II because of the submarine menace to shipping lanes and might be entirely cut off in another emergency.

Cost also has been an important factor. Before the war the oil sold as low as 8 cents per pound. After the war it went as high as 40 cents.

Price, which has fluctuated without notice, plus transportation difficulties, brought about the investigation sponsored by the American Iron and Steel Institute.

To discover and develop a substitute for African palm oil, Foundation scientists were confronted with what appeared to be an almost impossible list of requirements. The oil, to function properly, must have these characteristics:

It should make smooth, bright tinplate; drain rapidly and freely; possess low volatility; have high flash and fire points; neither oxidize nor polymerize readily; clean readily from the sheet; have low viscosity to permit pouring or pumping readily; be nontoxic, odor-free and preferably edible; should not become rancid during storage; not interfere with lithographing, lacquering or soldering, and should retard atmospheric corrosion.

And the substitute had to be inexpensive and readily available, preferably from domestic sources.

After extensive basic research on tinning oil action, the Foundation scientists selected dimerized linoleic acid (dimer acid) as having the best possibilities. This is a fatty acid product only recently available in quantity. It is made from common vegetable oils by heating them under pressure in contact with steam.

A mill test on this material was encouraging, although the dimer acid tended to increase in viscosity. Subsequent work was devoted to a study of dimerized acid base materials. Two general lines of approach were followed:

1. Correction of undesirable viscosity characteristics by use of addition agents.

2. Examination of various esterified dimer acid products which are known to have satisfactory low temperature viscosity characteristics and which give good resistance to heat bodying.

From their work the Foundation scientists have concluded that satisfactory tinplate can be made with 100 per cent free fatty acid if the acid is not too volatile or viscous.

They also have expressed the opinion that it may be possible to replace African palm oil with some of the natural Latin-American vegetable oils which await only the development of plantations and extraction facilities.

Courses in Electroplating

The *Institute of Electrochemistry and Metallurgy*, 59-61 *East Fourth Street, New York City*, will offer specialized courses in the field of electroplating and metallurgy during 1949-50. Advancements made in the metal finishing field during the war years are covered. Veterans can attend the School under the G.I. Bill of Rights. Registration for the fall term was held from September 19 to September 23, and the first class met on September 27. The following studies will be offered:

ELECTROPLATING I.

The course is designed to give the electroplater or industrial worker a foundation in chemistry including qualitative and quantitative analysis. One hour each evening will be devoted to class lectures in which will be discussed the theories of modern chemistry as applied to electroplating. The remaining hours will be devoted to the laboratory where the student will conduct his own experiments. Tuesday

and Wednesday from 7:30 to 11:00 P. M., *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Fee, $66.00.

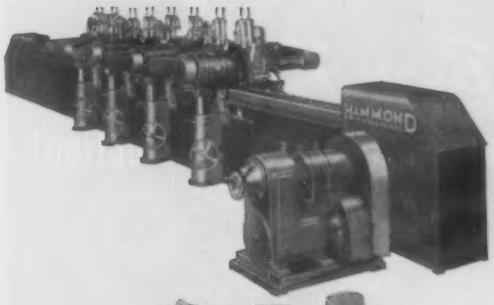
METALLURGY I.

The student will be introduced to the structure of metals and alloys and factors are taken into account which affect these, such as temperature, mechanical working, etc. The application of the phase rule to physical metallurgy will be discussed. Both binary and tertiary systems will be studied and illustrated. Heat treating, surface treating and testing of metals and alloys will be studied. Tuesday and Wednesday 8:30-9:30 P.M., *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Fee $56.00.

RESEARCH I.

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00-11:00 P. M. *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Fee $56.00.

Time payments may be arranged if desired. For further information call *Dr. C. B. F Young*, ORegon 3-6256 or Leonia, N. J. 4-3583.



FASTER FINISHING WITH Hammond

STRAIT-LINE AUTOMATICS

ROTARY AUTOMATICS

JUNIOR AUTOMATICS

There are ten new Junior Automatics in the Hammond Line, to be used with polishing or buffing wheels or with abrasive belts. Model E2PF shown.

Users of Hammond Automatics report 2000 pieces or more per hour, more uniform, better finishing, less operator fatigue and specially, *lower costs.*

Send one finished and several rough samples for complete engineering and production report at no cost or obligation.

Let us show you what a Hammond Automatic can do on your own work to speed-up production and reduce your finishing costs.

Hammond of KALAMAZOO "GOOD MACHINERY Since '82"

"HAMMOND OF KALAMAZOO *Good Machinery Since '82"*

Hammond Machinery Builders INC.

1601 DOUGLAS AVENUE ★ KALAMAZOO, MICHIGAN, U. S. A.

Business Items

Benjamin New Sales Manager for Abbott Ball

John G. Benjamin

The appointment of *John G. Benjamin* as Sales Manager of *The Abbott Ball Company, Hartford* 10, *Conn.*, has just been announced by *R. M. Terry*, Executive Vice President. He will succeed J. M. Taylor, who has resigned.

Mr. Benjamin will be in charge of sales for both the Bearing Ball and Burnishing Divisions.

McLaughlin Joins Wire Coating & Mfg. Co.

Mr. Raymond S. McLaughlin has recently been added to the engineering staff of the *Wire Coating and Manufacturing Co., Cleveland, Ohio.* He is a graduate of Purdue University, and has served for three years in the U. S. Navy as a commissioned officer. For

Raymond S. McLaughlin

GLOBE *Burr-Rite* Senior

Cuts Costs...Increases Production!

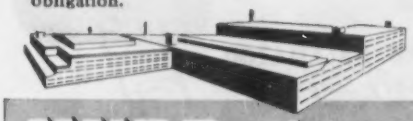
For
Mass Production
Precision
De-Burring

Produces Finer Finishes!
Saves Man-Hours of Hand Labor!

HUPP'S FREE
Experimental Service

Hupp's Experimental Engineering Laboratory will show you how to cut finishing costs. Send samples of parts to be processed along with finished part. There's no charge or obligation.

• Globe Burr-Rite Senior—the latest advancement in precision de-burring—finishes ferrous or non-ferrous parts and die-castings better and at lower cost. When desired, double or triple compartments permit de-burring and polishing at the same time. Larger, quick-opening aluminum doors and new hoist pan assure speedy loading and unloading. Write for specifications sheet.



Hupp Manufactures a Complete Line of Tumbling Barrels and De-Burring Machines

Dependable for 47 Years

HUPP CORPORATION
GLOBE STAMPING DIVISION
1250 WEST 76th STREET • CLEVELAND 2, OHIO
SERVING INDUSTRY SINCE 1902

the past three years he was associated with the General Electric Co. at their Erie, Pa., plant.

22nd Exposition of Chemical Industries

Organization of the 22nd Exposition of Chemical Industries has been completed and announcement is made that the exposition will be held in *Grand Central Palace, New York, November 28 to December 3*, 1949. All available exhibit space on four floors will be required to accommodate the exhibitors, many of whom have been consistently represented in the exposition since first held in 1915.

Exhibits will be composed of raw materials, machinery and products covering every recognized industrial and commercial application of chemical materials from medicinal preparations and foodstuffs to such important manufactures as paper, plastics, dyes and many more. Visitors at the last of these displays, which was held in 1947, represented nearly 60 different industrial groups, the leading ones being chemicals, industrial, research and testing laboratories, pharmaceuticals and drugs; foods and beverages; paints, varnishes and inks, foreign trade, paper and paper products, textiles, soaps and detergents. Total registered attendance was 50,016.

E. R. Weidlein, director of Mellon Institute, is chairman of the advisory committee of the 1949 exposition. The committee is composed of leaders in the major fields of interest which the exhibitors represent.

Camill New Agent for Sulphur Products Co.

Wilfred S. McKeon, President of *Sulphur Products Co., Inc.*, of Greensburg, Pa., announces that *Mr. Louis J. Camill* of Detroit has been appointed as a manufacturer's agent. Mr. Camill will solicit sales for the products of this company, such as McKeon's "*Zinc Brite*," "*Liquid Sulphur*," "*Tin Strip*," etc.

Louis J. Camill

Mr. Camill has had a large amount of technical and practical experience, particularly with zinc plating. He is currently connected with the Allied Research Products, Inc.

Fourth International Electrodeposition Conference

The 37th Annual Convention of the American Electroplaters' Society which is to be held June 11 to 15, 1950 at the Hotel Statler, Boston, Mass., U. S. A., is also to be featured as the Fourth International Electrodeposition Conference with the collaboration of the Electrodepositors' Technical Society of England.

Inquiries regarding reservations and details of the convention may be obtained by writing to the Convention Committee Chairman, *Mr. Manson Glover*, 376 Washington Street, Malden, Mass., or to the Society's head-

quarters, P.O. Box 168, Jenkintown, Penna., U. S. A.

Strong technical sessions are being planned including one session on "A.E.S. Research," symposia sessions on "Smoothing Processes in Metal Finishing," "Mechanical Finishing Processes," and "Advances in Electroforming, including the Graphic Arts," and a fifth session on "Miscellaneous Plating Subjects."

Papers are being solicited for these technical sessions both within the U. S. A. and Canada as well as abroad. As has been the custom in the past, the Editorial Board of the A.E.S. will review all papers submitted in making the selection of those accepted for the program. Papers not accepted for the convention program will be considered for publication in the Society's monthly "PLATING." Authors desiring to submit papers are asked to promptly advise the Executive Secretary at the Jenkintown address regarding the title of the manuscript. Copies of the Society's bulletins—"Offer Form for Convention Papers," "Regulations Governing Articles and Papers," and "Instructions to Authors" will be furnished upon request.

Information on hotel reservations and other details of the convention program will be announced throughout the winter and spring.

Electric Products Company Appoints New Chicago Manager

The Electric Products Co., Cleveland, O., has appointed *J. R. Williams* as District Manager of their Chicago office. This District covers the industrial area in the nineteen counties of the northern part of Illinois, all of Indiana, Iowa, Minnesota, Wisconsin, and most of the upper peninsula of Michigan.

J. R. Williams

Mr. Williams, who is a graduate electrical engineer from the University of Illinois, has a wide industrial background. Formerly associated with the General Electric Company in Philadelphia, his experience includes design and application engineering and sales engineering. He also served as district motor specialist for that area.

In his new position for the company, he will be responsible for promoting the sale of one of the widest lines of special electrical equipment, such as battery chargers, electrolytic equipment, synchronous motors, frequency changers, a-c and d-c generators and industrial dynamometers.

NEW TOOL FOR PLATING

A production tool for electro plating making it possible to produce more and better work with less cost. Surprisingly its cost to use is no more, and with less investment.

We are talking about BUNATOL No. 1000 Paste insulation for production racks.

It's the kind of insulation that is used with a minimum of labor and time, yet lasts sometimes longer than the rack itself. In every case the working life of this insulation is so long that its cost is negligible. But more important is the fact that the rack is so well protected that it produces more good work as compared to the usual insulation.

No. 1000 Paste is a 100% solids which forms in a single dip a heavy leather-like coating that will withstand all plating baths and cleaners. Permanently flexible and the coating rinses freely and does not drag out or carry over. When rack repairs are necessary patching the insulation is a simple quick operation.

You should know more about No. 1000 Paste insulation and its low price. Just write for complete information.

●

NELSON J. QUINN CO. • TOLEDO 7, OHIO

BUNATOL

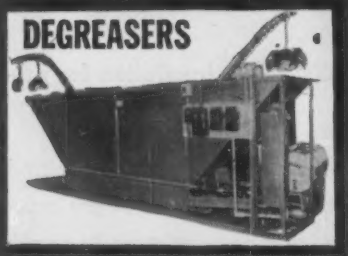
ELDRIDGE E. SEELEY

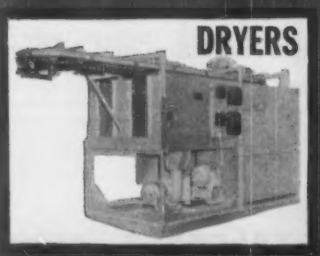
Mr. Eldridge E. Seeley, President of the *E. E. Seeley Co., Inc., Bridgeport, Conn.*, died at the age of 56 on June 12th at his home in Oxford, Conn., after a brief illness.

Mr. Seeley was the founder in 1919 of the firm bearing his name, which furnishes equipment and supplies to the foundry and metal finishing industries. Under his active direction the company has become one of the most successful firms in this field, with wide usage and distribution of their products.

Mr. Seeley will be missed by the many friends and business acquaintances he has built up over the years of his activity.

Is METAL PARTS CLEANING a bottleneck in your plant?





A complete line of OPTIMUS Equipment is available in standard and special sizes to meet every metal parts cleaning problem and allied processing applications.

OPTIMUS VAPOR DEGREASERS are available in all various types and stages, straight vapor, vapor-spray, liquid-vapor and combinations of these. All sizes from simple batch type degreasers to custom built monorail or cross rod conveyor models.

OPTIMUS METAL PARTS WASHERS — single or multiple stage — screw or conveyor, mesh belt or monorail types. Can be applied to a wide range of operations as well as the handling of rust preventatives and other coatings.

OPTIMUS DRYERS embody a specially designed system of directional air jets which assure spotless drying after plating or polishing and before subsequent painting, plating or lacquering.

Submit your metal parts cleaning problem to our engineering staff. SEND FOR complete catalog of OPTIMUS Equipment.

Distributors of
"Midsolv"
A Perchlorethylene Degreaser Solvent
"Triclene D"
A Trichlorethylene Degreaser Solvent

SEND FOR
COMPLETE CATALOG AND
ADDITIONAL INFORMATION.

OPTIMUS EQUIPMENT COMPANY
11 Water Street **Matawan, N. J.**
Offices in principal cities

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

Ralph R. Jenkins

numerous new chemical products and processes have been field tested and are ready for the market. It is claimed that the organization is engaged in the most elaborate and comprehensive research program ever carried on in connection with zinc plating and finishing.

Detrex Makes Several Personnel Appointments

Announcement of *D. E. Williard's* appointment as manager of industrial cleaning equipment and chemical sales for the Central Region of the United States has just been made by *W. F. Newbery,* Director of Sales, *Detrex Corp., Detroit.*

Mr. Williard is well qualified for his new position, as he has been with Detrex for over 15 years and has had

Azed, Inc., Formed to Produce Zinc Plating and Finishing Chemicals

Azed, Inc. (pronounced ā-zed), a new corporation jointly owned by *Poor & Company, Chicago,* and the *Acme Steel Company, Riverdale, Ill.,* has recently been formed to engage in the research, manufacture and sale of products and processes for all phases of the application and secondary treatment of zinc surfaces. The company will serve zinc electroplaters, hot-dip galvanizers and zinc-base die cast manufacturers and finishers.

President of the new corporation is *F. A. Poor,* Chairman of the Board of Poor & Company. Azed Vice Presidents are *C. S. Traer,* Chairman of the Board of Acme Steel; *C. J. Sharp,* President of Acme Steel and *A. E. Chester,* Research Director of Poor & Company. Vice President and Treasurer is *P. W. Moore,* President of Poor & Company. *P. W. Moore, Jr.,* is Secretary, and *R. R. Jenkins,* General Manager. Azed offices are located at 80 *E. Jackson Blvd., Chicago* 4. Laboratories are maintained at Riverdale and Waukegan, Illinois. The factory is at Waukegan.

Company officials state that the formation of Azed, Inc., is the outgrowth of over six years of research and development work during which time

D. E. Williard

W. H. Webb

wide experience in various sales, service, and production phases of the company's business. He is an expert on modern metal cleaning and finishing practices, and has been a key figure in the development of solvent vapor degreasing as well as alkali and emulsion cleaning.

Mr. W. H. Webb, who has had many years of experience with Detrex in analyzing cleaning applications of specialized nature, has been placed in charge of the alkali and emulsion phases of sales, service, and consultation in central United States. His broad technical knowledge on the use of such compounds and modern cleaning methods in general, will be of great value to the metal fabricating and finishing industries.

Alan Harris, who for some time has been concentrating his efforts on the field development work of Detrex cleaning compounds, will serve the metal industry in the Detroit area.

Alan Harris

CHROMIC, NITRIC and SULPHURIC

...all good friends of ATLAS Tanks and Floors!

ATLAS *designed corrosion-proof floor using* ATLASTIC 31 *asphaltic membrane, over which is laid* ATLAS ACID BRICK *jointed with* TEGUL-VITROBOND (R) *chemical cement.*

ATLAS engineers are prepared to help solve your corrosion problems. ATLAS custom designed tanks and floors of ATLAS chemical construction materials are economical and pay extra dividends in long trouble-free performance.

Inquiries receive careful analysis and prompt attention — no obligation.

THE ATLAS MINERAL PRODUCTS COMPANY

MERTZTOWN, PENNA. **HOUSTON, TEXAS**

T. Max Stanger to Head American Wheelabrator Salt Lake City Sales Office

The appointment of *T. Max Stanger* to the sales staff of *American Wheelabrator and Equipment Corp., Mishawaka, Ind.,* was recently announced. Mr. Stanger will have his headquarters in Salt Lake City, where the company has not previously had a sales office.

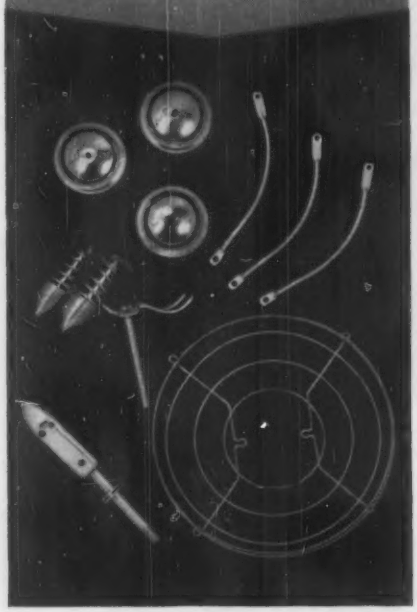
Previous to joining American Wheelabrator & Equipment Corp. nearly two years ago as a member of the service engineering staff, Mr. Stanger was associated with American Foundry and Machine Co. and with Pacific Bell Telephone Co.

Chenis Joins W. D. MacDermid Co.

Mr. Anthony J. Chenis has joined *The W. D. MacDermid Chemical Co.,* of Bristol, Conn., in the capacity of sales and service engineer. Mr. Chenis will travel the states of Connecticut, Massachusetts and Rhode Island and will continue to maintain his residence in Fairfield, Conn.

After graduating with chemical engineering degrees from Holy Cross University and Massachusetts Institute of Technology, he spent several years as a plating supervisor, and in 1940 joined the Bullard Dunn Division of the Bullard Company, Bridgeport, Conn., in the capacity of service and chemical engineer in connection with the Bullard-Dunn process.

COVER-RITE INC.
gets COVER-BRITE with LUSTER-ON®



Actual unretouched photograph

All over Chicagoland, Cover-Rite, Inc. is well-known as a high-quality job plater serving dozens of manufacturers with their metal finishing requirements. Samples of their work are pictured above.

Right now they feature their "Cover-Brite Zinc" finish as a process that is more eye-appealing than cadmium, with superior results in both handling and corrosion resistance.

No wonder they achieve these results — because Cover-Rite treats all its zinc plate with genuine *LUSTER-ON*, the original cold bright dip for zinc!

You, too, can give your products brilliance and protection against age stains, darkening and finger-marks by using *LUSTER-ON*. It's immediately available for either hand or automatic plating cycles. Send a sample of your product for free processing . . . and ask for the free *LUSTER-ON* brochure. 52

The Chemical
CORPORATION
54 Waltham Ave., Springfield 9, Mass.

Please send me full particulars about Luster-on bright dip for zinc surfaces. I am (am not) sending sample part for free dip. No obligation, of course.

Name.....

Firm Name.....

Address.....

George Schore to Represent Industrial Supplies & Equipment Company

Mr. Morris S. Shipley, president of the *Industrial Supplies & Equipment Co., King Street, Greenwich, Conn.*, announces the appointment of *Mr. George Schore* as a special representative for New York City, Long Island and certain special assignments.

Mr. Schore was formerly with the Detrex Corp, and has had many years of experience in the plating industry.

George Schore

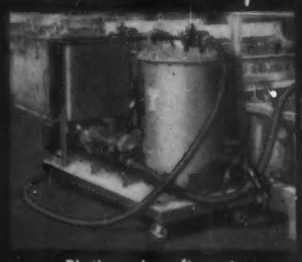
He will be in a position to assist users with the various products and equipment available from Industrial Supplies & Equipment Co., which includes designing and building of plating racks, coating of plating racks, degreasing machines and solvents, filter presses, drawing compounds and rust-proofing oils. Mr. Schore can be reached by telephone at MOtt Haven 9-2134.

Brown Instruments Makes New Appointments

Charles E. Sharp has been made Chicago branch industrial manager for Brown Instruments division of *Minneapolis - Honeywell Regulator Company*, it was announced by *W. H. Steinkamp*, Brown field sales manager.

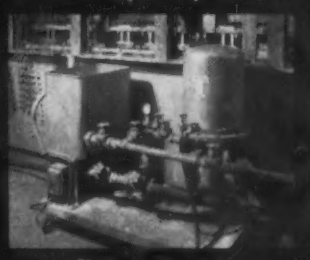
Sharp, who has been with the Chicago office for the past five years, succeeds J. A. Robinson, who has been made regional industrial sales manager for the Midwest and all western and Pacific Coast areas. Both men started with the Brown company at

There's a **Titeflex** FILTER *for every* PLATING JOB



Plating aircraft parts

Plating radio parts



Plating auto parts

Titeflex Filters are high in efficiency . . . low in cost. They require no replacement parts such as bags, sheets, etc. They are cleaned by an efficient backwash system, entirely eliminating waste labor. And they produce the highest possible degree of filtration. Plating shops throughout the country are finding Titeflex Filters the correct answer to their filtering problems.

Write for complete descriptive literature

Titeflex

The filter with the backwash

TITEFLEX, INC.
500 Frelinghuysen Ave., Newark 5, N. J.

Charles E. Sharp

its Philadelphia main plant about 20 years ago.

John A. Robinson has been named regional sales manager for the Midwest, Northwest, Rocky Mountain and Pacific Coast areas for Brown Instruments division of Minneapolis-Honeywell Regulator Company. Robinson started with the Brown company 20 years ago at the Philadelphia main plant. He will make his headquarters in Chicago where he has been branch industrial manager.

Charles D. McIntire has been named industrial sales manager of the Cincinnati branch office. McIntire succeeds *George Brown* who has been assigned to promotion of products of Honeywell's Belfield Valve division. Brown will supervise Belfield sales in the Central States region out of his headquarters in Celeveland.

John E. MacConville has been named industrial sales manager of the Atlanta branch office. MacConville will also supervise industrial sales activities out of the company's Birmingham, Jacksonville and Knoxville offices.

John A. Robinson

William C. Walthman has been put in charge of industrial sales out of the South Bend office. He succeeds George Gilliam who will supervise all pyrometer supplies sales for the company. Waltman was with the Syracuse, N. Y., office of Brown.

Industrial Ventilation Firm Is Organized

Formation of *Mechanical Industries, Inc.*, a new engineering company whose activities will be limited to industrial ventilation and fume control, has been announced by *Morton I. Dorfan*, president and general manager. Mr. Dorfan has been associated in this field more than 35 years. Prior to establishing the firm which he will head, Mr. Dorfan supervised dust control sales, engineering and research activities for the American Wheelabrator & Equipment Corp.

Previously he had served in similar capacities with Allis-Chalmers Co., Pangborn Corporation, Blaw-Knox Co., and as a private consultant to industry.

Mechanical Industries, Inc., is well financed and is being competently staffed to serve North and South Amer-

EVERYTHING YOU NEED IN A RACK COATING!

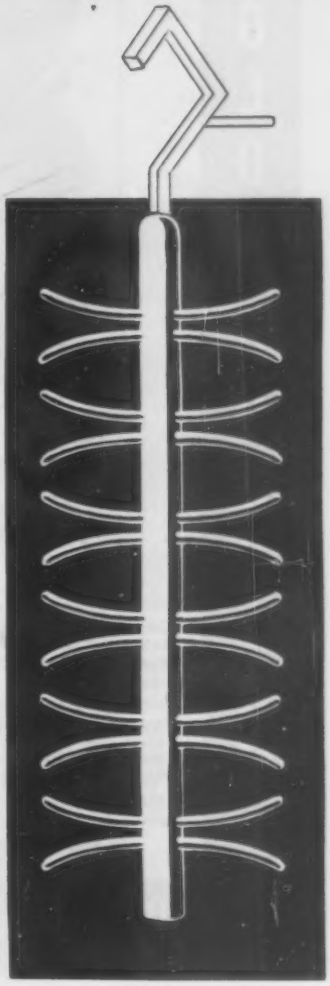
Unichrome Coating 218X—a plastisol—provides this top combination of properties needed for real service:

You get the ideal rack protection in Coating 218X. For (1) It resists abrasion and impact—so Coating 218X is not prone to mechanical damage! (2) It stands up in acids, and hot alkaline solutions, and even *degreasers*—so you can work it through *any* plating cycle! (3) This coating is easy to apply and has unusual adhesion! (4) To cap it all, a United Chromium Service Engineer gives you any technical help you require to do a top quality coating job.

No wonder Unichrome Coating 218X rates "EXCELLENT" in the report of a leading automotive producer. Another company is covering every chromium plating rack in the plant with it. A third user affirms never having a coating able to take rough handling and hundreds of vapor degreasing cycles like this plastisol! So it goes in hundreds of plants—longer service, lower costs.

You too can be sure of satisfactory applications. Get acquainted with "218X"—you'll profit by it. Write for more data.

Nearby applicators can do the coating job for you if you have no baking oven. Ask for names.



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Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of UNITED CHROMIUM, INCORPORATED

51 East 42nd St., New York 17, N.Y.
Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill.
Dayton 2, Ohio • Los Angeles, 13, Cal.

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GOLD & RHODIUM SOLUTIONS

GOLD and RHODIUM PLATING SOLUTIONS HEADQUARTERS

- Made in All Colors
- Colors Constant
- Brilliant Finish
- Tarnish Resistant
- Bottled By Troy Weight
- Made From U. S. Treasury Gold
- Ready For Immediate Use

DAVIS-K—makers of GOLD PLATING SOLUTIONS—prepared in all colors that produce hard, tarnish-resistant, color constant deposits.

Compounded from U. S. Treasury GOLD and highest (C.P.) chemicals. Sold by troy weight—certified 100% gold content.

Solutions are simple to operate and maintain.

We are fully equipped to reclaim your old gold, rhodium and silver solutions. Also wires or racks that have been used for precious metal plating.

We welcome inquiries pertaining to precious metal plating problems.

Distributors of Bakers' lustrous RHODIUM SOLUTIONS, that produce a long-lasting white finish.

"Where glittering elegance reflects lasting quality"

DAVIS-K PRODUCTS CO.

54 West 22nd Street ORegon 5-0094-5 New York 10, N. Y.

Get Metal Parts CLEANER!! FASTER!! CHEAPER!!

by using

CHEMCO'S EMULSION CLEANERS

- Embodies a New Principle of Detergency Causing the Soil to be Only Partially Emulsified in the Cleaning Solution. It Then Floats Out on the Surface of the Cleaning Solution Rather Than Remain in the Machine to Redeposit on the Work.
- Newer Emulsion Cleaners Designed to Reduce Material Usage and Produce Better Results.
- Longer Using Life, and Greatly Reduced Concentrations Afford Users a Definite Savings.
- A Blend of Synthetic, Surface Active Chemicals That Are Non-Corrosive, Completely Neutral and Fast Acting.
- Prevents Rust For a Number of Weeks.

Samples and further information supplied on request.

CHEMCO PRODUCTS COMPANY, Inc.

7740 West 47th Street Lyons, Illinois

ican industries in the control of smoke, dust and fume hazards. Headquarters are in the Frick Building, Pittsburgh, Pennsylvania.

Letter to the Editor

Chemical Stoneware Drains

Metal Finishing
11 *West* 42*nd St.*
New York, N. Y.

Dear Editor:

We were interested to read in the "Shop Problems" section of your August issue about the use of silicon iron drains for handling plating room waste. While we agree that silicon iron is a good material for this application, you should not overlook the fact that an even better material is chemical stoneware.

Chemical stoneware is corrosion-proof throughout and resistant to anything found in plating room waste except hydrofluoric acid. Many silicon irons have poor resistance to hydrochloric acid, a common chemical in the plating room, but chemical stoneware is entirely inert to the action of hydrochloric acid in any concentration.

Chemical stoneware drains, pipe, traps and acid neutralizing sump tanks when properly installed will outlast the life of a building.

Very truly yours,
S. A. LEWIS
Process Equipment Div.
The United States Stoneware Co.

Manufacturers' Literature

Ucilon Protective Coatings

United Chromium, Inc., Dept. MF, 51 *East* 42*nd St., New York* 17, *N. Y.*

Latest 4-page bulletin on Ucilon Protective Coatings gives information on four groups of coatings expressly developed for corrosion control, chemical resistance, and "heavy duty" industrial painting. Essential facts on various formulations are briefly outlined, and as evidence of their unusual chemical resisting qualities, cases are cited where systems of Ucilon coatings ended tough maintenance problems. The coatings are applicable

both to structural surfaces and to equipment in interior or exterior locations.

Corrosion Resistant Plug Valves

The Duriron Co., Dept. MF, Dayton 1, Ohio.

This firm has just issued several bulletins illustrating their line of Duriron corrosive resistant plug valves for use in handling highly corrosive solutions. Bulletin 637 illustrates a line of top lubricated plug valves for general service at medium pressures. Bulletin 637 describes their Type B pressure lubricated plug valves, while Bulletin 638 contains specifications on their bottom lubricated plug valves. These valves are available in a number of alloy compositions, enabling the user to choose the most efficient material for any given type of service. Copies of these bulletins are available from the above address.

Burnishing Balls

Pioneer Steel Ball, Inc., Dept. MF, Unionville, Conn.

A new bulletin just issued by this firm gives a lot of technical data and statistical tables on metal balls for burnishing and bearings. Included is reference material on stainless and carbon steel balls, bronze balls, and metal shapes used in burnishing operations, such as cones, balcones, diagonals, and ovalballs. Copies of the bulletin are available on request.

Titeflex Filters Catalogue

Titeflex, Inc., Dept. MF, 546 Frelinghuysen Ave., Newark 5, N. J.

Titeflex filters, which feature a backwashing system for ease of cleaning, are illustrated and described in a new 12-page booklet published by this firm. Included are details of construction, diagrammatic drawings showing how the filters operate, and information on the stone membrane and the wire mesh membrane. Individual insert sheets setting forth filtering recommendations for particular industries will soon be available.

Cleaners for Metals

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Just issued by this firm is Bulletin C-106 entitled "Cleaners for Effective Metal Cleaning." A feature of this Bulletin is a concise and very useful

IRIDITE gives galvanized parts

2-way **RUST PROTECTION**

A clean, sanitary appearance and freedom from corrosion are "musts" inside this beverage cooler manufactured by The Vendo Company, Kansas City, Missouri. That's why Iridite was chosen to finish hardware parts and the galvanized vending basket. Iridite stops galvanic corrosion because it forms protective barrier between dissimilar metals. Iridite blocks corrosion from moisture because it seals the metal from contact with condensed moisture.

3 WAYS TO USE IRIDITE

Iridite offers you a complete line of finishes for any zinc or cadmium surface . . . plated, die cast or galvanized, and for any finishing problem . . . corrosion resistance, paint base or eye appeal.

SIMPLE TO OPERATE

You'll find Iridite easy to use, too. It requires no special equipment or personnel, goes on with a short, non-electrolytic dip, dries fast and gives uniformly good results from manual or automatic application.

If you use zinc or cadmium in any form, you can use Iridite. Write today for data and samples, or, send specimens of your product for FREE IRIDITE PROCESSING. *Special note:* Ask about Iridite Bright for zinc or cadmium-plated parts. See how you can get durability and chrome-like brightness at amazingly low cost.

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IRIDITE COATINGS ARE USED ON

Washing Machine Parts
Radio Equipment
Kitchen Utensils
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Lock Hardware
Office Machines
Window Frames
Vending Machines
Wire Cloth
Tools
Lamp Fixtures
Fuel Pumps
Carburetors
Auto Hardware
Zinc Coated Sheet
Hinges, Screws, Bolts
Camera Parts
Plumbing Fixtures
Wall Panels
Refrigerator Parts
Wire Products
Instrument Parts
Electrical Equipment

WEST COAST LICENSEE—L. H. BUTCHER CO., LOS ANGELES 23, CALIFORNIA

PLATING AND POLISHING EQUIPMENT AND SUPPLIES

CLEAN-RITE ALL PURPOSE CLEANERS
PLATING RACKS • BUFFS • COMPOSITIONS

• • •

Let us help you solve your Finishing Problems.
Costly rejects can be reduced and the Finish improved.
Take advantage of our Practical Experience.

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Centralized Distributors
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TEL. CAPITOL 7-8800

table which gives specific recommendations for the cleaning of all commonly used metals. The table covers: metals to be cleaned, the soil to be removed, recommended soak and electro-cleaners, and special notes applicable to unusual types of work.

Contour Polishing on Abrasive Belts

Behr-Manning Div., Norton Co., Dept. MF, Troy, N. Y.

The latest Bulletin issued by this firm illustrates the advantages of abrasive belts in polishing articles having special and difficult contours. Several illustrations of production jobs successfully handled by belts are included. Copies are available on request.

Buffing Wheels

Barker Bros., Inc., Dept. MF, 1668 Summerfield St., Brooklyn 27, N. Y.

A bulletin just issued by this firm illustrates their manufacturing facilities and a complete line of buffs for the metal finishing trade. This firm has over two generations of experience in the manufacture of fine buffs, and has in many cases devised special processes to insure a high quality product. Included in their line are straight arbor and taper shaft buffs in many materials such as canton flannel, felt, bleached and unbleached muslin, worsted, chamois, and sheepskin. All types of sewing are available, and many special shapes can be made for individual special uses. Felt cones, knife-edged wheels, and bobs are also manufactured by this firm. Further details may be obtained by writing to the above address.

Corrosion Resistance of Stainless, Monel & Nickel Castings

Cooper Alloy Foundry Co., Dept. MF, Hillside 5, N. J.

This firm announces the publication of a new bulletin on corrosion resistance of stainless, Monel and nickel castings. This valuable comprehensive data sheet, prepared by *N. S. Mott*, Chief Chemist and Metallurgist, was designed primarily to aid materials engineers in their selection of the best alloy when the corrosive agents and conditions are known. Copies are available on request.

Bulletins on Properties of Phosphates

Monsanto Chemical Co., Dept. MF, St. Louis 4, Missouri.

Technical bulletins containing chemical and physical data on tetra-sodium pyrophosphate and sodium tripoly phosphate, describing in detail the function of each, are available from the Phosphate Division of Monsanto Chemical Co. Both complex sodium phosphates are widely used as detergent aids and as water softening or calcium and magnesium sequestering agents.

NEW BOOKS

Directory of New England Manufacturers

Published by the George D. Hall Co., 20 Kilby St., Boston 9, Mass. Price $30.00.

The fourteenth edition of this directory, published with the editorial cooperation of the New England Coun-

185,000 PIECES PER WHEEL HAVE BEEN BUFFED WITH
CHURCHILL FINGER-BUFFS*
DESCRIPTIVE LITERATURE AND SAMPLES ON REQUEST

SOLE MFRS.
GEO. R. CHURCHILL CO., INC.
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* TRADE MARK—PATENTS NOS. 2146284, 2350216. OTHERS PENDING.

Are You Satisfied With Your Finish?
Try
HARRISON'S
4A
COMPOUNDS
for
Aluminum, Brass, Copper, Stainless Steel, Carbon Steel, etc.
TRY OUR NEW GREASE STICK; ALSO OUR NEW WATER SOLUBLE COMPOUNDS.
Our technical Representative will be pleased to help you with your problems.
HARRISON & COMPANY, INC.
HAVERHILL, MASSACHUSETTS

cil, contains four sections in its 750 pages:

1— Alphabetical listing of firms, including their address, executives, products manufactured, number of employees, and capital.
2— Geographical listing by state, city and town.
3— Listing under products manufactured.
4— A listing of brand names and trade names.

In addition to these listings, the book contains much valuable data on economic data for New England, as well as the story of the various state manufacturers associations, governor's conference, and the New England Council.

Hardenability and Steel Selection

By W. Crafts and J. L. Lamont. Published by Pitman Pub. Corp., N. Y. C. Price $5.50. 260 *pages plus Bibliography.*

In this volume the authors have gathered all the latest information on the subject of steel hardenability, with special emphasis on methods for predicting heat treating results from calculations involving other data regarding the alloy, and combined it into a comprehensive text on the effects of heating, quenching, and tempering operations on the physical properties of the steels. A clear discussion is given of the various factors to be considered when selecting a steel for a given engineering application. Methods for testing steel hardenability are given, together with a discussion of the merits of each particular method and its field of usefulness. The book will find extensive use by the operating metallurgist or materials engineer charged with the proper selection of the engineering steels.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Hartford Branch

The Hartford Branch of the American Electroplaters Society will hold a reception and dinner in honor of *Mr. Arthur W. Logozzo,* newly elected president of the Supreme Society, at

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TWO MORE METAL SHOW EXHIBITORS

Due to some last-minute changes, the names of the following firms were unavoidably omitted from the listing of exhibitors in the Metal Show write-up on pages 54 and 55 of this issue:

J. C. Miller Co. ..... Booth 2341
Grand Rapids 4, Mich.
Buffing compounds, electroplating and polishing equipment and supplies.

National Lead Co. ..... Booths 2559 & 1112
New York 6, N. Y.
Lead primary products and special alloys for chemical resistance.

CORRECTION

To the readers of Metal Finishing:

Reference is made to an article entitled "Small Burnishing and Tumbling Machine" published in the September issue under the name of J. Szeremany, Department MF, 58 Lexington Avenue, Maplewood, New Jersey.

The name of Daniels Plating Barrel & Supply Company, 129 Oliver St., Newark 5, N. J., was omitted as the manufacturer; therefore, all inquiries for this equipment should be addressed to Daniels Plating Barrel & Supply Co., 129 Oliver St., Newark 5, N. J.

the City Club, Trumbull and Allyn Sts., Hartford, Conn., on October 15, 1949. Mr. Logozzo is a long-time member of the Hartford Branch, and is the second member of a New England branch ever to be elected to head the Society.

An interesting program has been arranged by *Mr. George B. Hogaboom*, chairman of the arrangements committee, including short speeches by several of Mr. Logozzo's business and personal friends, and an illustrated educational talk on "Plating in Motion and The Evaluation Of Electrodeposits" by *Mr. William Phillips*, Chief of Electroplating Research of the General Motors Corp., and a Past President of the national society.

Dinner will start the reception at 1:30 p.m., followed by the remainder of the above program. This time was chosen by the committee as being most convenient for those who might have some distance to travel in attending, as the program should be completed by late afternoon, permitting an early return home after the proceedings. No evening program is scheduled.

Mr. Logozzo is president of the *Nutmeg Chrome Corp.*, of Hartford, specialists in the chrome plating of dies and molds, and is widely known to the electroplating industry as an expert in this line, as a speaker on electroplating subjects, and as an all-around regular fellow. The Hartford Branch extends a cordial welcome to Artie's many friends to attend this reception in his honor.

Chicago Branch

The Chicago Branch of the American Electroplaters' Society is pleased to announce a new location for its regular monthly meetings. The new location is the *Western Society of Engineers, 84 East Randolph Street, Chicago 1, Ill.*

The Chicago Branch has the largest membership of any of the branches in the American Electroplaters' Society, and is extremely proud that they have facilities for their monthly meetings much more in keeping with the size and prestige of their Branch.

The new facilities include a lounge and dining room, in addition to an auditorium capable of seating 200 members. Modern public address and picture projecting systems are also available in the auditorium.

The first meeting was held in the new quarters on Sept. 9 with an attendance of 75 people. 45 members and guests met for dinner at 6:30 in the dining room. Following the dinner the regular meeting was held in the auditorium, with a number in attendance who were not present for the dinner. All of those in attendance were pleasantly surprised to find the very excellent facilities offered to the members and guests for their meetings.

The speaker of the evening, *Mr. William Gordon*, of *MacDermid*, gave an excellent talk on the removal of troublesome impurities from both copper and bright nickel solutions. The various methods for removal or reduction of organic and metallic contaminants discussed by the speaker were of interest to all in attendance. Following Mr. Gordon's talk the usual open question session was held in which some problems were quite lively discussed.

Los Angeles Branch

A technical panel on hard chrome plating, with four top-flight shop operators in that highly specialized field

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serving as panel members, and *Richard Wooley* of United Chromium, Inc. as discussion leader, was the educational session feature as Los Angeles Branch of the American Electro-Platers' Society resumed meetings on September 14 after a two-month vacation interim.

The program attracted an overflow attendance of well over 125. Branch president *Alan Sulzinger* introduced Mr. Wooley.

Four hard-chrome men, chosen for their wide experience and versatile knowledge of hard chrome plating, were seated at the speaker's table and subjected to a veritable barrage of questions by Conductor Wooley. Members of the panel were: *Leo Atimion* of Modern Plating Co., Inglewood; *Roy Lostutter*, Hard Chrome Products Co., Los Angeles; *Dexter Halldin*, Tool & Jig Plating Co., Los Angeles; and *Joseph Morrison* of the Anachrome Corp.

Preceding the questioning, each panel member was requested to give a brief outline of his experience in the hard chrome field. This revealed that members of the panel had been associated with the work as far back as 1927, when hard chrome plating was literally in its infancy.

The manner in which the forum was conducted by Mr. Wooley elicited the applause of the branch. He had outlined in advance a careful series of questions designed to elicit information on practically all phases of hard chrome plating. When each question had been propounded, each panel member in turn was requested to offer his opinion or explain the method used in his particular shop. After his conclusion of all discussion by the panel and audience at large, the various opinions and views were expertly condensed by Mr. Wooley who, in many instances added information on techniques and practices in various sections of the country that rounded off the subject in superb fashion.

The first subject concerned composition of solutions for hard chrome plating. Mr. Atimion revealed that in his shop he has used solutions ranging from 33 to 52 ounces of chromic acid content. He expressed the opinion that less waste or dragout results from using a 33 ounce solution, which also can be controlled better and produces a more satisfactory deposit than higher concentrations.

Mr. Morrison remarked that in his opinion solutions ranging from 33 to 54 ounces of chromic acid content will work well, depending upon the type and shape of work being plated. "On some work I get better results from a 53 ounce solution," he said, "particularly on thread work, for which we prefer a higher concentration."

On the ratio of chromic acid to sulphate, the comment was as follows:

Mr. Morrison: "I use strictly a 100 to 1 ratio."

Mr. Lostutter: "I use a ratio ranging from 80 to 1 to 125 to 1. On the whole, 100 to 1 is preferable, but in some cases, where small parts are involved, better results sometimes can be obtained by allowing some leeway below 100 to 1—say 80 to 1 or 85 to 1."

On the effect of temperature on hard chrome plating operating conditions, one panel member disclosed that for the average run of work he maintains temperatures at from 126 to 130 Deg. F., going as low as 116 Deg. F. for

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some work, the operating temperature depending on the object being plated, anode efficiency, and other factors. Another member admitted using average temperature of 125 to 135 Deg. F.; a third panel member said he never goes below 125 nor over 140 degrees Fahrenheit.

On rectifiers versus motor generators, the concensus of opinions of the four panel members was that, in a straight production line, a rectifier will serve as well as a generator, although, it was agreed, a generator permits more flexibility in operation and will, on the whole, use less current.

Other subjects discussed during the two hour panel included: The effects of impurities in the hard chrome bath; tanks and tank linings; methods of heating solutions; external heat exchangers; racks and racking problems; current distribution; robber wires; masking techniques; anodes.

Spirited counter discussion was encouraged from the membership at large, and nearly every subject on which the four panel members presented their views, brought confirming or counter views from the floor. The program was voted the most interesting and educational that has been presented by the branch in many years. A wire recording of the entire proceeding was made so that each member may receive a copy of the discussions.

Guests at the meeting included: *Max Laska*, Mefford Chemical Co.; *Miss H. Gaye Carlson*, C & C Buff Co.; *Louis Nanchy*, General Electric Co., Ontario, Calif.; *William Castell*, Lockheed Aircraft Co.; *Barker Woodward*, Tool & Jig Plating Co.; *G. A. Lagutaus*, Santa Ana Plating Co., Santa Ana, Calif.; and *John Clark*, Anachrome Corp., Los Angeles.

AMERICAN SOCIETY FOR TESTING MATERIALS

At the recent 52nd Annual Meeting of the ASTM held in Atlantic City a number of items of importance to electroplaters and metal finishers were acted upon. Probably the most important of these actions was the acceptance as a Tentative Specification of a *Method for the Preparation of High-Carbon Steel for Electroplating*. This specification supplements two other former tentatives which were adopted as Standards:

B 177-45 *Recommended Practice for Chromium Plating on Steel for Engineering Use*

B 183-43 *Recommended Practice for Preparation of Low-Carbon Steel for Electroplating*

The high spots of the new Tentative Recommended Practices for the Preparation of High-Carbon Steel for Electroplating are as follows:

1—Preclean

Solvent degrease, emulsion clean, or spray wash to remove gross contamination and to lessen the burden on the subsequent alkaline baths.

2—Electroclean (Anodic)

All electrocleaning should be anodic only, in order to lessen the possibilities of hydrogen embrittlement. Parts for barrel plating are usually soak-cleaned only. The anodic cleaner should be at a temp. of 190°F. or higher,

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and a current density of 50 amps/ft² or higher should be used.

3—Rinse

Rinse first in a warm (120°F) rinse, then a cold water spray-rinse.

4—Acid Dip

To remove the last traces of scale or oxide, a dip for as short a time as possible in hydrochloric acid is recommended. Sulfuric acid is not recommended because of its tendency to form smuts.

5—Smut Removal

Smut and light oxides present after the hydrochloric acid treatment are removed by making the parts anodic in 6 oz/gal. solution of Sodium Cyanide. About 1 minute at 15-20 amps/sq. ft., room temp. An alternate treatment for lighter smuts is an anodic treatment in an alkaline cleaning bath for 15-30 secs. at 25-50 amps/sq. ft. Bath temp. above 160°F.

6—Etching

Anodic etch in a 250-1000 gm/1. sulfuric acid bath. Temperature below 78°F. Time—1 min. at a current density of 100-400 amps/sq. ft. The addition of 125 gm/1. of Sodium Sulfate (anhydrous-basis) is beneficial to some grades of steel.

7—Plate under standard conditions.

Tin and cadmium are easier to plate on this material than is zinc.

8—Heat Treat after Plating

To remove hydrogen embrittlement, parts are baked at a temp. of 300-500°F for periods of 1-5 hrs., depending on the severity of the embrittlement. Baking should be done as soon as possible after plating. 400°F. maximum is recommended for zinc and cadmium plated parts.

Also among the actions taken was the acceptance of revisions in Tentative Specifications for *Plated Coatings of Zinc and Cadmium on Steel* A (164-40T and A 165-40T) and in the Specification for *Chromate Finishes on Plated Zinc, Hot-Dip Zinc, and Zinc Die-Cast Surfaces* (B 201-45T). These revisions for Cadmium and Zinc plating specified that the plated and treated parts were to be free of hydrogen embrittlement, leaving the methods for checking this condition up to an agreement between manufacturer and purchaser. Other minor revisions involved selection of samples, and acceptance and rejection provisions.

The most important provision of the revision in the Chromate Treatment specification was in the matter of aging of all specimens for 24 hours before testing, and a provision that only cleaning the surface of treated samples with a clean dry cloth was permissable before testing.

The Society also accepted revisions in the Tentative Method of *Salt Spray (Fog) Testing* (B 117-44T).

Also adopted as Standard were the following Test Specifications:

A 309-47—*Test for Weight and Composition of Coating on Long Terne Sheets by the Triple Spot Test*

A 153-47—*Specification for Hot-Dip Zinc Coatings on Iron and Steel Hardware.*

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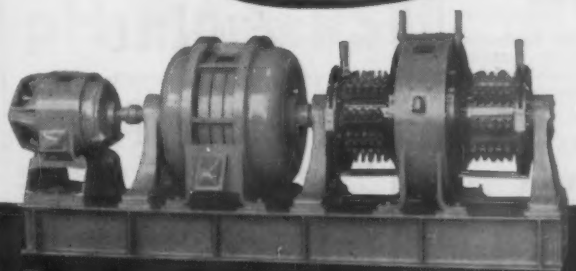

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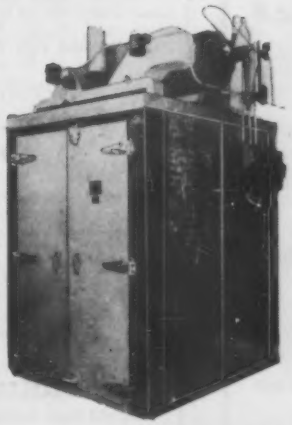

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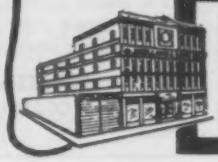

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News from California

George Kent, formerly associated with D. N. Eldred in the Eldred-Kent Laboratories, Los Angeles, and *Harold Shepard* have established themselves as *Shepard & Kent*, serving as LaSalco distributors on the West Coast. Headquarters are at 3132 *East Washington Blvd., Los Angeles*. Shepard had served individually as LaSalco representative since the retirement from that position of Frank Rushton several years ago.

E. C. Gratcyk, formerly associated in an engineering capacity with Acme Blower & Pipe Co., South Gate, Calif., and *A. F. Erikson* have established the *Erikson Manufacturing Co.* for manufacturing air washers, paint spray booths and equipment, dust collectors and industrial incinerators. Incorporation papers were recently received and a plant has been opened at 130 *West Schmidt Road, El Monte, Calif.*

Ray Baugh, formerly superintendent of Cadmium & Nickel Plating Co., Los Angeles, and *Guy Pearson*, foreman of the plating shop of the Hollymade Hardware Co., Los Angeles, have purchased the *Accurate Plating Works*, 1018 *North Broadway, Los Angeles*, and propose to operate it as a general job shop and zinc plating specialty shop.

The *Sam B. Crooks Company*, distributors of industrial products, including plating and finishing supplies, recently moved from 204 East Manchester Ave., to enlarged office and warehousing facilities at 1401 *South Santa Fe Ave.*, same city.

A baseball game engaged in at the recent annual picnic of Los Angeles Branch of the American Electro-Platers' Society between a team manned by plating shop operators and personnel against a team of supply house men resulted in a victory for the Platers by a score estimated at 22 to 10. The platers, ably assisted by Umpire *Don Bedwell*, settled the issue in the first inning by pounding out two hits, which, combined with nine errors and six bases on balls, resulted in the scoring of approximately 11 runs. The approximation of the scoring becomes necessary because, in some instances, some of the obese members of the Platers' team went directly from second base to a shady spot under a tree, "stipulating" they had scored. Supply Men pitchers were slugged for a total of 21 hits. The Platers were superior also in the error column, committing only 11 miscues in five innings, compared with 34 by the Supply House men. In an exclusive interview with METAL FINISHING, *John Millhorn*, captain of the Suppliers, announced himself as not too disappointed at his team's showing, declaring that it certainly "showed whom we should not let play next year!"

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NATIONAL METAL SHOW

(*Concluded from page 55*)

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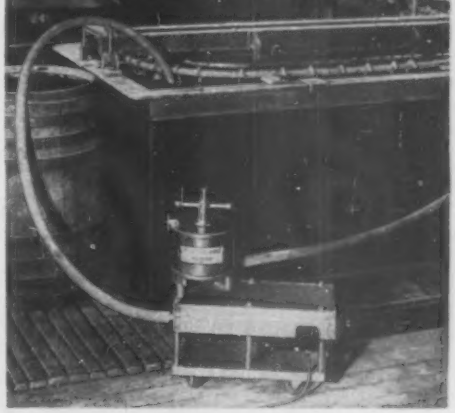
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